THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

Vol. LXV.] CONTENTS: October 8, 1909. [No. 1,663.

	Page
Electricity and Miners' Panic	561
The Arbitration Clause	562
The Newfoundland Cable Dispute	563
Curative Electricity (*illus.*)	564
Notes on Trade Abroad (*continued*)	564
Cable Fault Localisation Graphs in Practice (*illus.*)	568
Proceedings of Institutions:—	
Production of Iron and Steel by the Electric Smelting Process (*illus.*)	570
The Determination of the Economy of Reversing Rolling Mills	571
New Electrical Devices, Fittings and Plant (*illus.*)	572
Correspondence:—Magnetising Current of an Induction Motor—Notes on Trade Abroad: Are we Indifferent—A Peculiar Phenomenon—Prospects in Chile—Not wanted in Australia—Coefficient of Self-Induction—Electric Laundry Irons with Indicators—Tramway Power Tariffs—Unemployment	574 to 577
Business Notes	577
Notes	583
City Notes	586
Electric Tramway and Railway Traffic Returns	588
Stocks and Shares	588
Share List of Electrical Companies	589
Metal Market.—Fluctuations in September	591
Notes on Electric Practice in Mines	591
Simplicity in Design	593
Turbo-Electric Propulsion	593
Municipal Tramways Association:—	
The Central Repair Depôt of the L.C.C. Tramways (*illus.*)	595
Current Consumption (*illus.*)	597
Some Comparisons of Continental and British Methods of Operating Tramways	597
Electrical Steel (*illus.*)	598
Foreign and Colonial Tariffs on Electrical Goods	600
New Patents Applied For, 1909	600
Published Specifications	600
Contractors' Column ... ... Advertisement pages 68 and 70	

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ELECTRICITY AND MINERS' PANIC.

IN a previous issue of this journal we had occasion to refer to the resolution which was brought before the Durham Miners' Association with regard to the use of electricity in collieries. That resolution called for the removal of electrical apparatus, and presumably the complete system in each case, from mines, on the ground that it was considered a source of great danger. The resolution was shelved, upon the intimation that the matter was to be considered by a Select Committee; it must be pointed out, however, that this course of action by no means indicates a restoration of confidence in electricity on the part of the miners. It rather shows that they have confidence in the power of the Committee to sift the matter to the bottom, and in the willingness of the owners to assist in this action. The problem is not disposed of, but only postponed; if quietness has supervened, it may be only the lull before the storm.

As a matter of fact, however, the affair does not rest here. The Durham miners' resolution was valuable in the same way that a straw shows which way a stream is running. Following the analogy, the volume of the stream of opinion is now sufficiently large to carry a haystack. On October 5th the annual meeting of the Miners' Federation of Great Britain was opened at Newcastle-upon-Tyne, and at that meeting a resolution was to be presented to the effect that, in view of the dangers of electricity in dry and dusty mines, Parliament should be called upon to enforce the removal of electricity from such mines.

In order that not one of our readers may fail to weigh up the true significance of this development, it may be worth while noting that the Federation consists of authorised delegates from the whole of the district or county miners' unions included in this Federation. Practically speaking, a resolution passed at this meeting represents the consensus of opinion of the whole of the pitmen of the country. If such a resolution as is given above were adopted, it would be a very grave and potent factor which, by arresting the growth of electric applications in one of their most promising fields, would affect, directly or indirectly, almost every member of the electrical profession.

It is not likely that the resolution has been passed; it was too drastic even for panic-stricken men. Even if it had been passed, it is in the highest degree improbable that Parliament would be persuaded to give effect to its meaning. But the moral effect upon the men themselves—the men who must do so much to co-operate in the making or marring of the reputation of electricity—would be enormous. The growing panic would be crystallised into a definite expression of opinion shared by every section of the country, which it would take years to eradicate. Even the very fact that such a resolution was put forward at a National assembly is a very disturbing matter.

This being the case, is it not advisable to attempt to do something to allay the panic, and so to "stop the rush" pending examination of the question by the Select Committee? The confidence of the miner is a thing to be striven for, and in these days, when business-getting methods in electricity supply are so loudly advocated, such a simple and necessary matter as going to some trouble and expense to convince the actual users of electricity of its safety under

proper conditions should hardly require advocacy. Probably, however, it will not be done because it is so obvious.

For example, it is evidently the large power supply companies who would stand to lose most heavily if supply were terminated. Why cannot they combine with the manufacturers of reputable electrical plant in order to establish, to the satisfaction of representatives chosen by the men themselves, the safety of electricity by suitable demonstration and explanation? The cost of assembling apparatus and supplying energy for such a purpose would be negligible compared with the advantages to be gained.

Again, it is obviously to the advantage of every electrical manufacturer, supply authority, and consulting engineer interested in mining work to do all in his power to educate the man down the pit to the proper use of electrical plant, and to improve his intellectual status in this direction. Such a course should also have the benediction of colliery managers and engineers as improving the common conditions of safety. In such a connection the aims and objects of the Institution of Mining Electrical Engineers can be commended; and it is well worth the effort of the electrical fraternity to develop the mental capacity of the mine electrician.

With such simple palliatives as these, the present inflamed state of feeling among miners can speedily and easily be reduced. The ultimate test will, of course, be the decision of the Select Committee, but much will have been gained if, in the meantime, steps can be taken to meet the emergency.

THE ARBITRATION CLAUSE.

Of the clauses in engineering contracts which demand the attention of contractors, there is none more important than that which relates to arbitration. The clause which substitutes a self-appointed tribunal for the courts of justice has become common form in most contracts for works of any magnitude; and howsoever the contractor may object, it is almost impossible for him to secure the deletion of the clause.

The ostensible reason for an arbitration clause is to provide that disputes of a technical nature shall be settled by a technical man. But that is not a sufficient reason, as it is quite easy for both sides in any action to agree to refer the matter in question to arbitration. Further, it is common practice for judges who are asked to decide cases full of technicality to say: "This is a matter which must be referred to an official (or special) referee." If an official referee is appointed, he probably hears the case, fortified by the knowledge acquired in countless similar cases which have been before him; if a special referee is selected by the judge, he is chosen because of his special skill and knowledge of the subject under discussion.

But, it may be asked, is there no way out for the contractor? Will the Court allow an arbitrator to act who is known to be biased?

Procul, O, procul este Profani! should be the cry of Justice against arbitrators who set out to act partially in the discharge of their duties.

Fortunately the Courts have a discretion in the matter. If it is shown that the chosen arbitrator is, *without the knowledge of one of the parties*, in such a position that he cannot be expected to act impartially, the Courts will remove him. The words in italics are, however, important; for if a contractor submits to having disputes settled by an engineer who is employed by the other side, he must abide the consequences.

Why cannot the determination of all technical disputes between contractors and local authorities be submitted to the arbitrament of persons appointed by the Court? One reason, at any rate, will occur to the mind of the contractor. It is that, by following the ordinary procedure, and by relying on the arbitration clause in the contract, the local authority or other employer may virtually choose their own tribunal; may even secure the appointment of their own engineer or surveyor as arbitrator. We have frequently shown how regrettable it is that contractors should have to submit to such treatment, but the fact remains that only very seldom is a contract signed with a local authority in this country which does not contain a clause providing for reference of disputes to the paid servant of the local authority.

When parties enter into a contract they must be taken to appreciate its meaning. If a firm who enter into a contract know that the work must be carried out to the satisfaction of the engineer employed by the other party to the contract, they must understand that an expression of that satisfaction will be a condition precedent to their right to recover on the contract.

A case which is quoted in a recent legal text-book* may be cited in support of the proposition that the mere fact that an engineer acting as arbitrator is the paid servant of the corporation, is not sufficient to disqualify him. In Jackson *v.* Barry Railway Co., 1893, 1 Ch., 238, a contract by which the plaintiff undertook to construct a dock for the defendant company provided that disputes should be referred to the company's engineer. A dispute arose as to whether the contractor was entitled to use marl instead of stone for a certain embankment. In a letter addressed to the contractor, the engineer expressed the view that the contractor was bound to use stone. The matter was then referred to the arbitration of the engineer, who, after the commencement of the arbitration, again expressed the same view in a letter. In these circumstances the contractor sought to have the reference to arbitration stayed on the ground that the engineer had shown himself to be biased. It was held by the Court that considering the position of the engineer who, as an engineer of the company, must necessarily have expressed an opinion on the point in dispute, his writing the letter after the commencement of the arbitration would not disqualify him from acting as arbitrator unless on the fair construction of the letter it appeared that he had made up his mind so as not to be open to change it on argument.

This is a strong case to show how the contractor is tied and bound by the decision of the engineer.

We now come to a case which was heard in the Court of Appeal at the end of July last, which has a very important bearing on the subject under discussion, inasmuch as it suggests a way of escape which may sometimes be available.

Assume that the point at issue between the contractor and the corporation is one which closely affects the conduct of the engineer himself, can he be called upon to arbitrate? The facts of the case in question were very simple. Messrs. R. Blackwell & Co. had contracted to do certain tramway work for the Derby Corporation. A certificate was given by the engineer of the Corporation, but a sum of £1,500 had been deducted under a penalty clause in respect of delay. Messrs. Blackwell objected to this penalty on the ground that the delay was really caused by the Corporation, through their engineer, in not allowing proper facilities for proceeding with the work. The contention of the company was that the borough surveyor, who was appointed engineer under the contract, acted improperly and unfairly towards them. He did not, according to their view, distinguish between the duties of an impartial engineer under the contract and what he would like to do as borough surveyor.

The contract contained a very wide arbitration clause providing that all differences should be referred to the engineer. Ignoring this clause, the company brought an action against the Corporation in order that the dispute might be settled in the ordinary way by the ordinary tribunals of the land. The Corporation took out a summons to stay the action, on the ground that the dispute must be decided

* "The Law Affecting Engineers," by W. Valentine Ball. Constable & Co.

by arbitration. It was contended, on the part of the company, that to allow the matter to proceed to arbitration would really be to allow the engineer to be the judge in his own cause, as his conduct was to be called in question. Counsel for the company argued as follows :—"I say that, whoever the arbitrator was, if, as a matter of fact, he was the particular person attacked, there is such a strong probability of *bias* that justice could not really be done." He pointed out that this case differed from all other reported cases in this respect—namely, that the engineer would have to be a witness on the other side.

Upon the case going to the Court of Appeal, their Lordships unanimously came to the conclusion that the engineer should not act as arbitrator, and that the company were entitled to have the decision of the Court. "Each case," said Lord Justice Moulton, "must be decided on its facts, and, in my opinion, where the nature of the dispute arising from facts which were subsequent to the contract is such that we are of opinion that the tribunal is not likely to be able impartially to deal with the dispute, it is open to us, and it would usually be the duty of the Court, to refuse to enforce the arbitration clause. . . . Corporations are, in my opinion, often too fond of putting officers of theirs in the position of engineers under a contract, and they forget that, as they are performing other duties to the Corporation, there may arise a conflict between their duties in these other offices and their duties as engineers under the contract, which may give rise to unfair treatment to the contractor by reason of the zeal with which officers perform their other duties."

The point was very clearly summarised by Lord Justice Buckley, when he said : "The fact that the Referee was the officer of the Corporation was not sufficient ground, but the point here is that the contractor's case—whether true or not is a matter to be determined—is this : I could not complete my contract in time, and the reason why I could not complete it in time was that you, the contractual referee, were an unreasonable person ; you hindered me in every conceivable way ; you would not let me deposit any material in such a way as it is usual to allow me to deposit my material—in advance of my work—you placed all sorts of impediments in my way . . . . How could you expect him to say, if he is a person of any character at all, that the acts which he did were unreasonable acts ? It is not human nature to suppose that he can properly determine that he himself is an unreasonable person. That is the subject matter of the dispute . . . . I think that there is sufficient reason why the matter should not be referred, being such as this is, to this particular gentleman."

So far as we can see, this marks a considerable advance towards the emancipation of contractors from the rigours of an arbitration clause. If it can be shown that the point at issue is whether the engineer has allowed his duty as engineer to his employers to conflict with his duty as engineer under the contract, to the detriment of the contract, it ought to be possible to obtain a stay of the arbitration proceedings.

The Newfoundland Cable Dispute.

In our issue of 1st inst. there appeared a letter signed by Mr. Ward, the manager in England of the Commercial Cable Co., to which it was impossible to reply last week owing to its late arrival. Mr. Ward takes exception to various points made in an article on the above subject printed in our issue of August 20th. It may be mentioned *en passant* that it has taken Mr. Ward 38 days to answer them, so that his replies may be stated to be well considered.

Perhaps it would be well to take the last paragraph of Mr. Ward's letter first, as it is supposed to lay bare the ignorance of the Press and to give the public an idea that his company is, after all, really British ! It is done in a *Quod erat demonstrandum* style, which might easily convince those who do not know better ; but, unfortunately, the Mackay Companies—an American trust company—has already anticipated Mr. Ward, for the reports of this combine state that "the Mackay Companies still owns the whole or part of the capital stock of 102 prosperous cable, telegraph and telephone companies in the United States, Canada and Europe, including the entire *capital stock of the Commercial Cable Co.*" Mr. Ward may be able to explain, if the entire Commercial stock is held by the Mackay Companies, how much is left in the hands of the British investors, for these statements do not agree.

The mere fact that English investors hold a certain amount of stock in the Mackay Companies does not make the control British, and in this respect, the appearance of a Reuter telegram in the Press of the 4th inst. is rather opportune, for it contains the statement that the Cable Co. (Commercial Cable Co. owned by the Mackay Companies) has decided to ask the United States Government to intervene in the cable dispute.

In his second paragraph Mr. Ward says that his company does not own a landing at Port-au-Basque. The cable to this place is, of course, owned by the Newfoundland Government, but the Commercial Cable Co. controls the Canso end, and in its tariff mentions the cable among its connections. From a traffic point of view, therefore, Mr. Ward's company has a landing, and the statement in the article was made with this point in view, as it is there stated that the cable was "worked in conjunction with their system," not that it was owned by the company.

With reference to paragraphs 3, 4 and 5, it was not stated in the article that the Commercial Co. had a monopoly, but merely that the Newfoundland Government was unwilling to grant it. Moreover, nothing can be gained by calling a monopoly pretty names. The Colony already owns an outlet *via* Port-au-Basque, and, in case of interruption, it perhaps does not matter much whether the 1s. per word is handed to the Anglo or to the Commercial Co. ; presuming, of course, that the latter company has not granted a reduced rate to the Government.

From Mr. Ward's letter it would appear as if his company were merely benefiting the Colony without regard to its own advantages ; but, as stated in the article, by the diversion of one of its cables to Newfoundland (it is the intention of the company apparently to similarly divert others) the Commercial Cable Co. has increased its speed by 35 per cent., and if the Colonial Government is so anxious to be hostile to the Anglo Co.—it would appear from Sir Edward Morris's action that this is not quite the case—all messages collected by its landline system would be transmitted by the Commercial Cable Co.

Why, if the Government is so active a competitor of the Anglo Co., is it necessary for Mr. Ward's company to have direct dealings with the public? The company would obtain all the traffic and would be saved all the expense of its collection.

Coming now to paragraph 6, Mr. Ward's mathematical deduction "which is absurd," is not so, for the traffic contract, if passed, excludes the Anglo Co. from all traffic collected by the Government lines, with which the Premier does not agree. The tendency nowadays is for Governments to own or acquire all telegraph lines, and if this be done in Newfoundland, where would the Anglo Co. be? Sir Edward Morris possesses the foresight of a statesman.

The object of Mr. Ward's reply in paragraph 7 is doubtful, as the article did not call into question conditions of working in the United States, but as he mentions them, perhaps he can state whether the Anglo, Direct United States, German or French companies would be allowed to own or lease their own landlines, as is done in the United Kingdom, to important traffic centres ?

In regard to paragraph 8 Sir Edward is, judging by events, not in accord with Mr. Ward, and has drawn attention to *ex parte* statements.

The point made by Mr. Ward about the land is comparatively trifling. What does it matter who owns the land ? Mere ownership does not convey a title to land cables on it, and had not the authority of the Newfoundland Government been obtained, the land leased from a private citizen would have been absolutely useless for the purpose for which it was acquired.

CURATIVE ELECTRICITY.

By R. M. M.

Electricity as an aid to the medical profession has lately come very much to the fore, and an assortment of apparatus varying between a cautery instrument taking 1 ampere and a Finsen light set or high-frequency coil taking 40 amperes, has been connected to public supply mains. Where the doctor can treat patients at his own house, or at an infirmary, the supply of current is a simple affair, but when the patient has to be treated out of reach of the supply mains, special apparatus—a portable battery—has to be brought into use.

For faradisation, galvanisation and electrolysis—the last two more particularly—the usual practice is to have a set comprised of cell selector switch, reversing switch, milliammeter and battery of dry cells assembled in one case; with an alternative of a separate box for wet cells of the so-called plunge type in which one element is removed from the solution when the battery is not in use. When, however, the set is designed for all three processes, it is customary to use the dry cell type of battery.

In the electrolytic treatment, by which a drug is conveyed to the affected part electrically, the current is small, mostly a maximum of 5 milliamperes, but as the resistance of the patient is naturally high, 20 to 40 volts are required for the process, depending, of course, on the patient's skin, size of contacts, and the drug employed. Many patients can be

Medical Battery of Accumulators.

treated with a smaller voltage, and therefore one problem, similar to the regulating cell trouble in station work, presents itself—namely, the last cells tend to get the least work to do. In some sets a double selector switch, by means of which any cells can be included in the circuit, obviates this trouble, but the disadvantage of such an arrangement is that it doubles the chance of accidentally leaving a cell short-circuited.

The next trouble met with is that the dry cell has only a short life under usual working conditions, although on test it may give very good results. The consequence is that one or more new cells have to be substituted from time to time, and in most cases the complicated connections are such that the owner usually prefers to send the whole set away to the makers to have the renewals made. A further disadvantage is that with the ordinary cells used the terminals can be accidentally short-circuited very easily.

Bearing these weak points in mind, a set for faradic and electrolytic treatment was recently designed for a doctor by Mr. S. T. Allen, Carlisle. For the battery 18 small accumulators of a type put on the market not long ago were fitted at the bottom of a case 6 in. × 6 in. × 10½ in. inside dimensions. Connections from the cells are made by means of a wooden board carrying a number of brass pins fitted below with countersunk nuts, and on the top with lock nuts and connecting wires going direct to the selector switch. The pins can thus be first adjusted to make good tight connection with accumulator spring contacts, and then the board may be removed entirely from the box to have the selector wires attached, thus removing all danger of accidental short-circuiting.

As the cells are designed to give 0·2 ampere for four hours, the life at one charge for medical purposes can safely be put at a long period, with the additional advantage that the cells can be charged up again during the night by connecting them in series with an 8-c.p. lamp. At definite times the contact board and selector can be lifted out of the case, and the cells removed, examined and replaced in *any* order by anyone with common sense, thus giving the advantage of making each cell do equal work. The bottom of the contact board is carefully coated to prevent any damage being done by acid fumes during charging; the cells are of such design that the acid cannot be spilt, and, therefore, it seems that the majority of the disadvantages of the old type sets have been overcome successfully.

A milliammeter is fitted in the lid of the box, and provides one of the terminals for the electrode connections, the other terminal being on the selector switch. For charging purposes connection is made on the off side of the instrument and on the selector switch.

The comparison between the dry cell and the accumulator type is :—

	Size.	No. of cells.	Volts.	Weight.
Dry cell ...	4½ in. × 9½ in. × 11	18	18 to 23·4	16 lb.
Accumulator...	6 in. × 6 in. × 10½	18	36 to 40·5	15 lb.

From time to time correspondence occurs on the subject of portable batteries for mains testing purposes, the usual requirement being high voltage, low current and portability. As all three can be obtained from the small accumulator with a decrease in the total weight for equal volts, it is likely that several batteries as described above may come into use at an early date, and thus save the poor cable engineer many a swear word.

NOTES ON TRADE ABROAD.

(*Continued from page* 492.)

The Knowledge of Tongues.

In a good deal of the advice that has been given from time to time in regard to strengthening British relations with countries where there are already, or ought before long to be, greatly improved chances of doing business, emphasis has been laid upon what we may describe as the language difficulty. The average Englishman knows very little of, say, Russian, Chinese, or the languages of Turkey, and probably the commercial men of these nationalities know as little of the English tongue, or coinage, or weights and measures. So far as the electrical trade is concerned, the probability is that the man who knows sufficient concerning electrical affairs, though he may be possessed also of that excellent quality salesmanship ability, is lacking in the linguistic attainment, and too often we meet men who have set themselves to the study of a number of foreign tongues to the exclusion of cultivation of other kinds, so that, excellent as they may be as office translators of correspondence, they are not the men one would select to send into the foreign field on a campaign of negotiation or business-getting. We should think that, given a man of fair knowledge of the trade, a reasonable acquaintance with commercial affairs, some experience "on the road," and a good knowledge of some of the at present rarely acquired languages, there should be a promising sphere of operations lying before him in the next ten years in securing business for British electrical manufacturers.

A Point to Consider Before "Changing Over."

It is better, perhaps, for some men that they should find their way to the lands of the Golden West, labouring under the open canopy of Heaven until they find the development of the vast country so far advanced as to stand in need of their electrical assistance. They never will lose their interest in electrical engineering matters in which they have received six or seven years of training, and though they may get more or less out of touch with electrical

advance if they do not read the ELECTRICAL REVIEW as they rest 'tween whiles from their tilling and their ingathering, the elements are there to be turned to good account when electrical engineering becomes as prosperous a calling as that of farming or fruit-growing. Others may leave the calling of their youth and "take orders," while yet others enter the brewing and cognate industries, and seek solace in vending licensed liquors at a wayside inn or petrol spirit for motorists at a roadside store. If these things are not to their liking, there are businesses of quite another kind in the West End where they may find a remunerative outlet for their irrepressible electrical energies. To all who see wisdom, in the present state of things, in embracing such callings, we bid our fond and may be temporary adieus, and wish them more power to their elbow with more grist to their mill; but there are young men of spirit and ability who would do well to look into this foreign language question and this salesmanship ability matter before they abandon the pursuits of their youth and seek a field where they hope to have a less competitive fight and a greater scope than they believe electricity to be able to present to them in England. The men who take these sudden plunges from one calling to another are the men who live for to-day, and often enough we believe—we may be wrong—that they have not adequately pondered the vista of future electrical possibility. If there is the foreign business to be got, and other electrical manufacturing nations are sending their technico-commercial agents to the necessary countries to secure some of it, and, like Caleb and Joshua, they are returning with examples of the spoils that may be there for the rightful getting, why, in the name of all that is electrical, cannot our own "live" electrical men, who know the home manufacturers and have an aptitude for finding out and meeting the requirements of the foreigner, add to their already excellent attainments of an educational and personal nature a complete conversing knowledge of the tongues of those countries where there will be electrical requirements to be met for a score of years yet to come?

A Travelling Personality and Reliability.

With the existence of the right men, possessing the qualifications that we have but lightly touched in the foregoing, we believe that more of our manufacturers would be willing to launch out into the deep, in spite of what they say sometimes about not being able to afford it. Some of them cannot afford it, perhaps, because of their "once bitten, twice shy" attitude, owing to their having been "done" by the man they sent, or to the representative being a man whom they ought to have known better than to send. We have heard enough complaints of fruitless journeys, the failure of which has been due to the unsuitability of the haphazardly selected traveller. We do not do this sort of thing in a panic as a rule if we are manufacturers of standing who expect to continue in the business, and there are plenty of men about of unquestioned technical ability and unfailing moral reliability if we can only get them to couple thereto the business way and linguistic knowledge.

We do not ignore the fact that that important quality personality is more a matter of natural endowment than of practical attainment, but we have seen raw, unfinished, recluse sort of men with a little practice develop a wonderful business-getting way—not merely hustling; while reticent sort of men have developed an interesting talking ability which sometimes counts in selling against a trans-Atlantic rival, and unpolished careless sort of hang-together men have evolved a manner and a style which carry an air of success. We are not attempting to pen a Smiles's "Self Help" or other such guide to the young, but we think it right to suggest to the younger men in the electrical industry, many of whom seem just now to be allowing their hands to hang down and their hopes to fail, that they have a part to play in battling the British Battle in the foreign markets of the world, by studying the matter of their own fitness in the directions named. Let them remember that every man who goes abroad and secures business for our factories is making occupation, not for himself alone, but for many fully-trained electrical engineers who stay at home, and for an army of workmen. In doing a good thing for himself, he is acting as a public benefactor too, helping to solve the country's problems.

Turkey Moving.

For nearly a couple of years past the British Chamber of Commerce of Turkey, which was established in 1887, has been issuing from Constantinople a *Quarterly Trade Journal*. The September number that recently reached us contains a good deal of matter that is of value to the British exporter. Consequent upon the establishment of constitutional government, a new era has dawned which, in a country so remarkably unequipped with modern facilities, must call for great railway extension and other transportation systems and means of communication and general progress, which shall lead to increased exchange of commodities between Great Britain and Turkey. The introduction of foreign capital will, of course, be an inevitable factor in the development, and in this connection great importance attaches to the establishment of the National Bank of Turkey, with our own Sir Henry Babington Smith as its presiding genius. It is to be hoped that this will lead to a wise co-operation of British and Turkish capital, giving British enterprise free play, and British manufacturers useful business. The British Chamber of Commerce of Turkey is doing valuable service in endeavouring to promote a community of interests between the business men of the two countries, and it desires closer intercourse, such as that which was enjoyed a few weeks ago when representatives of the Ottoman Chamber of Deputies made a stay in London, followed by a tour of the principal English commercial centres, visiting Newcastle, Manchester, Liverpool and Birmingham.

Promoting Good Relations.

Another effort that is being made to bring the two peoples into closer touch is the attempt in Constantinople and England to spread the knowledge of the Turkish language amongst Englishmen, and the knowledge of English among the younger generation of Turks and other Ottoman subjects. The issue of the *Journal* before us contains a full list of members of the Chamber, and we are pleased to note among the English membership such names as Crompton, W. T. Glover & Co., Mather & Platt, Robey, Galloway, and Musgrave, British Insulated & Helsby, and Ruston Proctor. The copy contains a translation of the new Customs Regulations which came into force in August last, and these may be perused by any interested member of the electrical trade who makes personal application at the ELECTRICAL REVIEW offices. There is also an interesting article on tendering for Turkish Government contracts, which indicates that while Government departments have improved their system of doing business in recent years, one still sees a trace of the old methods. "Their requirements are generally published in the local papers, but too short notice is given," and sometimes adjudications take place in a few days, before anybody save one or two individuals is aware of the fact. Friends are called in to "reduce the price by a centime or two," and the order is placed, to the disadvantage of the Government and to the exclusion of would-be tenderers. This, the writer good naturedly suggests, is "when goods are wanted in a hurry." The War Office, however, is conducting business in a far more orderly manner, and has recently introduced the system of sealed tenders. There is also sometimes laxity in compelling all tenderers to comply with the conditions respecting deposits with tenders, according to the writer of the article named. A number of French firms have sometimes combined in putting up the requisite 10 per cent. deposit money, and the same course has been followed in the case of German tenderers; the writer suggests that British firms might consider the wisdom of doing likewise where big sums are involved.

Improving Her Ways.

A Cromptonian Success.

It is mentioned that Crompton and Co., Ltd., secured an important order for projectors for the Army, to the value of £18,000, their price being £500 per set lower than that of the French and Germans. "This order was only obtained after a long stay (in Constantinople) of their representative, and after tedious negotiations." It is added that, notwithstanding troubles of the kind indicated above, the Turkish Government is "a better client than any merchant in Stamboul." "The British manufacturers are prepared to give any Stamboul merchant

credit, but hesitate to give the same credit to a Government whose annual *revenue* is more than the *capital* of all the merchants combined." We gather that foreign commission agents are helping British trade as much as or more than are local Englishmen, who display "a lack of interest . . . in this work."

A Good Thing for Somebody.

The foregoing is all more or less by way of preliminary generalising. Let us go into a little more detail. Next week (October 14th) the Government is going to consider sealed tenders submitted to the Ministry of Finance for the installation of the telephone by private enterprise in Constantinople and its environs. It is stated that none of the tenders will be opened before the date named, and that they will all be opened on the same day before a technical commission, and the concession will be granted "to the tender offering the best conditions to the State." We shall be very much interested to learn, in the course of a week or two, whether any British parties are bidding for this very substantial and valuable concession, which presumably will carry with it a great deal of good business for everything required in a telephone system for the country which succeeds in securing the undertaking.

Other Concessions.

Undoubtedly electric lighting and power and traction and other like concessions will be ready for us to "put in for" ere long. In Asiatic Turkey, Jerusalem and Damascus are provided with electric lighting and tramway services.

It is already known that there is a German-French combination of financiers (with certain Swiss and Belgian bankers also) in existence for the purpose of promoting electrical enterprises in Turkey and the East.

A British Consul at Adana said not long ago that electric light had been installed (water power) in Tarsus by a Swiss engineer, and that a big scheme was under consideration for light and power to all three towns of Adana, Tarsus and Mersina. The Board of Trade in this country received details of the scheme as soon as they were obtainable. It seems that a rival 3,000-H.P. water-turbine scheme for Tarsus, promoted by the owner of a new cotton mill there, has already led to a provisional sort of contract for the machines being given to a Swiss engineer if the concession be secured. It is timely to note the coming of new projects and to be as ready as may be for them. Germany has had things far too much its own way in the matter of electric appliances in Adana in the past, and "there is no reason why British firms should not enter this market."

A Constantinople correspondent of a Washington newspaper in writing on the opportunities opening up for the promotion of trade in Turkey, described the country as being so old, and so far behind, that it is "practically a virgin field for engineers and capitalists."

China is not less cut by railways or marked with other western improvements. In Constantinople are 1,750,000 people within a radius of 10 miles from Galata Tower, without electricity in any form and with less than eight miles of car tracks. An American contractor, representing a combination of various interests, has recently applied to the Turkish Department of the Interior for the telephone rights of the city, and is at work on plans for several street railways. Another American here talks of harnessing the water-power in the various rivers and streams about the capital in order to use it in electrical projects which he has in hand. The Government has already drafted projects for more than 3,000 miles of railways, the construction of which is desired at once. Almost all the proposed lines are in Asia Minor, in the richest regions of the Empire.

It is the Turks' intention to give no more absolute concessions to foreign companies, which in every case hitherto has tightened the grip of some European nation upon the land. They intend to invite foreign capitalists to do work for them. Comprehensive bids will be received and the best proposition accepted. Though the railways will be held by the foreign companies for a number of years as a guarantee for investments and as a measure of compensation, everything will be from the beginning nominally Ottoman. The scheme, in other words, is, for the present, at any rate, very much that of a homestead building society.

Turkey in General.

The American Consul-General at Smyrna strongly recommends the establishment of a branch house, for the reason that Smyrna is the gateway to Asia Minor, and in a few years the whole trade of the interior will pass through Smyrna instead of Constantinople. The Smyrna Province is by far the richest in the whole Empire. "Asia Minor has, as yet, been entirely unexploited, but will not long remain so." Another Consul, at Aleppo, in writing on the methods required in trying to secure markets in more particularly northern Syria, shows the folly of expecting to do good business with a people with whom you never come into contact, and with whose manners and customs and languages and methods of doing business you have practically no acquaintance. American firms have sent to the Consul for free distribution batches of circulars relating to articles totally foreign to the country, and of which the people possess absolutely no knowledge, the lists being printed in English notwithstanding that the commercial language of the place is French. This Consul deplores the manner in which American travelling men ignore the Consulate, pointing out that a little conversation might give him valuable light regarding the manners and customs of the people, which might make all the difference between a success and a failure. This writer emulates the methods adopted by European exporters in handling the market, and if it be true that there is "hardly a line of American manufactures . . . that could not find a market here," it is equally true that British electrical manufacturers have a greater chance in the future than in the past as the development of the country proceeds along the normal course.

In Turkey, as in some other countries, it is next door to hopeless to look for securing orders merely through the mail with correspondence and printed matter. "The native will not purchase an article unless he first sees it." The mail-order system is also shown to be a very unfavourable way of conducting business in Asia Minor. Americans sometimes inquire whether it could not be used as a means of sending American goods in small parcels to the market, but the Smyrna Consul says:—

Catalogues would have to be printed in at least four languages, namely, English, French, Greek and Turkish, and correspondence would have to be carried on in the same languages. It costs money to get up attractive catalogues in Greek and Turkish, and yet this would have to be done if it were intended to do any business with the interior of the country. The expense entailed in sending parcels from New York to Smyrna, and especially to the interior of the country, would be large. Although there are six foreign post-offices in this city, namely, English, French, Austrian, German, Italian and Russian, I am not aware that there is any especially developed mail-order system in use by any of them. . . . On the other hand, it would be impossible to send parcels through any of these post offices into the interior of the country, for the reason that they only exist in the seaport towns of the Empire. Then, again, the numerous Custom House formalities necessary to clear small parcels would greatly militate against the mail-order system as a means of trade expansion.

"Advice to those about to—"

It seems that few or no British commercial travellers find their way to Mersina, while many foreigners do so, and British goods are imitated cheaply by some of those who do sell. Then again, in Crete very few "commercials" arrived at Canea in 1908, whilst experienced men from Austria, Germany and Italy are continually visiting not only Canea, but Candia and Rethymo. It is advised that travellers should visit Crete on their way to or from the Levant, but they should be men able to speak either Greek, Italian or French. "British commercial houses are still apparently unconvinced that the mere despatch of their ordinary English catalogues, in which the measurements are given in yards and inches, and the weights in cwts. and lbs., while prices are quoted in sterling, is sufficient for the needs of the small local firms"—then follows the now usual statement that our competitors are doing very different therefrom. "How long, O Lord, how long?" Here is a summary of suitable advice to those about to try to push the importation of British goods into Crete:—

(1) The appointment of a thoroughly trustworthy agent, with plenty of samples.

(2) Leniency in granting credit. The ordinary terms are: Cash on receipt of goods less from 2½ to 5 per cent. discount, or acceptance of drafts of from four to six months from the date of arrival in Crete. Previous information can always be obtained at a Cretan bank as to the financial standing of clients.

(3) Promptitude of execution of orders and care that goods sent correspond with what have been ordered.

(4) Give special attention to careful packing.

(5) Quotations for British goods should be made c.i.f. Crete, inclusive of packing and insurance charges.

(6) Small orders not to be despised; see what they may lead to.

(7) English is very little understood in Crete. The local language of commerce is Greek, French, and sometimes Italian. Quote as far as possible in the local currency and give metric measurements.

Give Long Credit Generally.

An American, who imports a good deal of trans-Atlantic material into Smyrna every year, wrote to an American Consul-General not very long ago, setting forth a point for closer consideration by those anxious to develop their trade connections there. We print the following extract as showing the desirability of British manufacturers stretching a point, wherever possible, in making convenient terms as to payment :—

One of the most serious drawbacks to the development of American trade with Turkey seems to be the rather unusual mode of reimbursements asked by the American manufacturer, of remitting the cash with order. While I do not wish to be interpreted as advocating easy terms of payment for the consumer in Turkey, yet I think that a certain latitude in the way cash payment is made would materially encourage business. The American manufacturer is very eager to have his goods introduced into new markets, and would be very glad to find buyers in Turkey, yet he is not prepared to meet the buyers in the matter of reimbursements, for he shows himself too strict in the matter of cash payments to make any business possible. He should at least content himself with the condition of selling his goods for cash against shipping documents upon arrival of the steamer carrying the goods at the port of destination, instead of requiring a remittance of the amount ordered two or three months in advance of the delivery of the goods—a system much objected to by the buyer and not in use in this market.

I think the American manufacturer could be easily induced to make a concession in this direction which, besides, contains no real danger to his interests, if the facts of the case were officially brought to his notice, and in view of the beneficial effects which may result from such course.

Of course this point is not a new one, and in every business which has dealings with a country which has not stood on the most lofty pedestal for commercial rectitude, such considerations must arise again and again in the course of the year. The above writer, however, has an intimate acquaintance with the people and their ways, and he suggests that it is unwise to pay too great a heed to the risks.

But sometimes none at all!

But before the ink of this is dry we cannot forbear alluding to the fact that business houses have suffered loss through dishonest methods of parties in that city. It transpired that in and around Smyrna an organisation existed purely with the object of swindling foreign merchants. Sending bills of lading in excess of real value of shipments, shipping raw materials from Turkey of lower quality than ordered, and short weights, were among the methods employed in the swindling operations. The organisation was known locally as the "Black Band" and consisted of men released from prison after serving sentences for frauds practised on European (English and German) firms. They obtained £50,000 from such firms in the course of ten years. The Governments published through our Chambers of Commerce the names of the persons forming the "Band," and the warnings given had a salutary effect; with the aid of the shipping companies the "Band" was practically boycotted and could ship no goods to Europe. When this occurred in England and Germany our electrical firms were not thinking much about doing electrical business in Turkey. Now if they contemplate doing trade there, they will find it worth while to ascertain the names of the offenders from our Chambers of Commerce. These men were apparently engaged in *exporting* only from Smyrna, but the existence of the "Gang" is sufficient to remind one that fraudulent practices are capable of variation for importation also, and names may be changed to suit any purpose you please, so it will be as well to weigh up the pros and cons and feel one's way with discretion. Of course there are sharks everywhere, more or less, and every now and again "long-firm" swindles are discovered in the best of countries—sometimes they lie even at our very doors.

Many reforms in the Customs have been introduced during the service of Mr. Crawford as adviser to the Government, and the Porte has asked for his services to be permitted by the British Government for a further three years, in order to ensure the success of these reforms.

Turkish Travellers.

An American Consul at Constantinople advises that quotations for any goods should be made c.i.f. the destination, or if the inquiry comes from an interior city, c.i.f., the nearest important Turkish port—Constantinople, Smyrna, or Beirut. On the importance of the commercial traveller as a trade builder, this Consul cites an interesting and telling case :—

A number of firms addressed this office in reply to a report mentioning an opening for certain goods. All except one are still in the correspondence stage, the exception being a firm who sent their European traveller a copy of the Consul-General's letter giving names of likely agents. This traveller came to Constantinople, visited one or perhaps several of the parties whose names were mentioned in the letter from this office, became satisfied with the standing of one, took an order for 15 machines from this person, appointed him agent for Turkey, and left by the same steamer, without breaking his journey. This may be an exceptional case, but it proves that what can be achieved in an hour by personal interview may not materialise with months of correspondence, and also that if a business is worth having at all it is worth going after.

French, German and Italian firms, although they may have been established here for 20 years and their business be on a firm footing, send their travellers regularly twice each year. These visit their old customers, with their agent, take note of any complaints or changes in requirements, and in the former case, if the complaint is well founded, with an expression of regret and judicious expressions to show goodwill, give a rebate on the last order, or even an extra discount on a new one. By such means they are able to retain a customer who had made up his mind to place his orders elsewhere. This can all be done by personal interview, with a direct representative of the firm; whereas correspondence, often heated, or an agent without full powers to act, would have failed. Of course it is part of the travellers' duties to canvass for new orders, which they are better able to secure than even the most active agents.

One of the United States Consuls advises American people to undertake excursions to Turkey in periods of commercial dulness at home. Not only Turkey, but many other countries, he suggests, might be embraced in one trip. He adds that "a good way would be to have a number of excursions organised at the same time, with competitive lines avoided. It would be best to limit the number in each excursion to 50, arranging a systematic tour to reach special markets for special goods." This is similar to the foreign tours that we advocated in these notes in our issue of September 10th, page 410.

Many a Mickle Makes a Muckle.

Consul-General Harris writing to Americans on the trade outlook recently said that this was just the time for American merchants and manufacturers to make a thorough study of Turkey, and gradually wedge in so that they might be able to get a good share of the trade "when the boom comes on, which is sure to be the case as soon as the financial world gets accustomed to the new order of things." He advised that wherever possible Americans should establish their own agents in Smyrna, employing American citizens if possible, but failing that, European firms should be given the preference "for the reason that disputes can be settled in the respective Consular court of which the agents are subject," "American houses should give a credit averaging three months if they are sure of their representatives." Small beginnings must not be thought of contemptuously, as we have said above, and as Mr. Harris shows in the following interesting remarks on the electrical trade :—

"One Smyrna firm informed me that an attempt had been made some years ago to get the agency of an American electrical firm. The reply was that unless half a million dollars worth of business could be done in the first year, it would not suit to enter the field. A German agency was then secured, which was willing the first year to install an electric plant costing $15,000. To-day the two largest electrical companies in Berlin are ably represented in Smyrna. They began several years ago by accepting every proposition whether large or small. Just now when all restrictions against the importation of electrical appliances into Asia Minor have been removed, and a great tidal wave of electrification, so to speak, is passing over the country, it is not difficult to prophesy who will get, not only the large concessions for trams and lighting in the cities, but the trade attendant upon supplying all the necessary wires, machines, apparatus, &c., as well. If that American firm had been willing to make a small beginning a few years ago, it would now be in a position to get a good share of the trade. As it

is, not a single American electrical establishment is represented in Smyrna."

We hope that any reader who was inclined to imagine that the past trifling electrical connections between this country and Turkey did not justify us in devoting much space to the subject has now changed his mind. It is because Turkey, like China, is now being borne on the wave of modern awakening, because that awakening will cause enormous strides to be taken to make up for lost time in getting into line with other nations, because there is already a real electrical opportunity well above the horizon, and because some British firms have lately shown what they can do there, that we have endeavoured to bring out the importance of a market which, in view of the present position of affairs and our favourable financial relations with the Turk, should yield business for the electrical employers and employed of the United Kingdom.

(*To be continued.*)

CABLE-FAULT LOCALISATION GRAPHS IN PRACTICE.

By EDWARD RAYMOND-BARKER.

Introduction.

Nearly six years ago a series of articles by the writer met with kindly acceptance on the part of the Editors of the Electrical Review, and from August 14th, 1903, till April 1st, 1904—inclusively—duly appeared in the columns of that journal.

The said articles began with a summarised re-statement, based on a uniform and systematic nomenclature, of various cable-break localisation methods and formulæ, and went on to deal in detail with graphic methods especially as connected with the Raymond-Barker calculator-board.

Most of the articles above-mentioned have since reappeared in booklet form.* The reprint, if one may judge by its sale, has been cordially received by the submarine cable community and others to whom, therefore, the writer feels very grateful.

It so happened that in August, 1903, the writer ventured to bring the Electrical Review article descriptive of the calculator-board to the attention of the editor of another leading technical journal with a view to mention, and, possibly, criticism. The editor of the latter journal, quite within his rights, politely expressed inability to see that any object would be served by reference in his journal to the calculator-board, whatever he might subsequently do when the thing should be further developed, and "results of some actual tests on cables" should be available. The writer, though at first disappointed, on second thoughts became convinced that this editor was perfectly right, and allusion is now made to the incident solely by way of point to the introduction of a further series of articles on graphic methods.

A period of well-nigh six years has slipped by since what has been described happened. During that time much additional matter has been collected and useful experience gained; also fresh light has been thrown on graph possibilities as applicable to modern localisation methods and geometrical proofs.

Thus the "results of some actual tests on cables" foreshadowed in a way by the editor, have now not only come into being, but have accumulated so prolifically from the hands of friends—not to speak of tests perpetrated by the writer himself—and are so varied in their nature that, in certain classes of examples, it becomes difficult to choose from an *embarras de richesses* that number of examples which, without undue diffuseness, will adequately represent results achieved in this interesting line of work. In any case, this pleasant task will be attempted in the following articles. These will comprise also much original matter, the result of personal observation, and not without its usefulness in supplementing information given in the text-books.

This will more especially be so in the writer's graph routine for Mr. E. S. Heurtley's exposure test, the polarity of test currents under various circumstances, graphs illustrating the effect of telluric currents in cable break localisation, &c.

Here and there in these articles graphs may appear which, in connection with the writer's name, have already appeared in recent new editions of well-known text-books. This fact is solely due to the kind initiative of the authors of the books in question who have had welcome access to the writer's portfolio of blue prints.

Since the completion of the present series of notes in MS., a new edition of Mr. H. D. Wilkinson's well-known work, "Submarine Cable-Laying and Repairing," has appeared, in which the author, in his usual lucid style, has dealt with certain fresh matters which happen to have been touched upon also by the writer of the articles to which these remarks are by way of introduction, such, *e.g.*, as those relating to the relative suitability of *zinc* and *carbon* currents for localising purposes under various conditions. This particular matter, by the way, the writer some time ago had the advantage of bringing to the attention of Mr. Wilkinson, especially as relating to the paucity of information up to then given in the text-books regarding the frequent instances, in practice, of the impracticability of using for break localising purposes the *zinc* or *negative* current. Indeed, amongst not a few writers it seemed to be a generally received axiom that localisation tests must be made with the negative current, and no explanations were forthcoming as to the exceptions which, under certain conditions, must arise in contravention to the aforesaid otherwise excellent rule. Mr. Wilkinson has certainly added considerably to the somewhat sparse information on this subject hitherto found in the text-books.

The writer's treatment of these matters will be found to be chiefly by graphs, and to follow the lines of his graphic proof of the false zero method of testing conductor resistance contained in an article by him published in the Electrical Review of October 10th and 17th, 1885, an article which, in regard to one matter in which the writer was not sufficiently explicit, drew from Mr. C. E. Rimington a useful criticism and a valuable addition to the writer's graph proof. These were acknowledged and replied to from Madeira by the writer in the Electrical Review of December 12th, 1885.

Since his completion of the MS. for the present series of articles, the writer has had his attention drawn by his friend, Mr. C. W. Schaefer, to a communication published by Messrs. G. K. Winter, M.I.C.E., and G. B. Winter in the *Journal* of the Institution of Electrical Engineers in June, 1893: "On a Graphic Method of Studying Behaviour of Exposed Ends of Broken Telegraph Cables, and of Means of Eliminating the Effect of Earth Currents and of Polarisation at the Fault."

It so happened that the said valuable article was published in London during an absence of many months from England on the part of the writer, who, until Mr. Schaefer's kind reminder, has remained unaware of Messrs. Winter's work. As, however, in the writer's method of treatment, there are several considerations and points of detail not referred to in Messrs. G. K. and G. B. Winter's most interesting communication, the writer will venture to leave his own work as it is, and he submits the same respectfully to all interested in these matters whether masters—in the scholastic sense—or fellow students.

The numbering of the figures in the following notes will follow on in regular sequence from fig. No. 37, which was the last diagram in the writer's former series of graphs completed in the Electrical Review for April 1st, 1904, and afterwards reprinted in pamphlet form.

Graphs in Practice.

Fig. 38 shows a reduced facsimile of a tracing from the Jona graphs as left recorded on the writer's calculator-board in the testing-room of a well-known cable ship on her return from a long repairing charter for a foreign Government, and a number of cable repairs.

The writer was not on the staff of that particular ship, so the fact that the localisation curves which happened to have been left by the electrician on the celluloid sheet of the

* "Hand-Book in Cable-break Localisation." By E. Raymond-Barker. H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London.

calculator-board were only a few out of the many obtained during cable operations and used as definitive, speaks volumes for the confidence inspired in minds other than the writer's own by the use of the calculator-board for Jona and other graphic methods.

A cable-ship electrician taking part in a long series of cable repairs in quick succession, and busy with all the

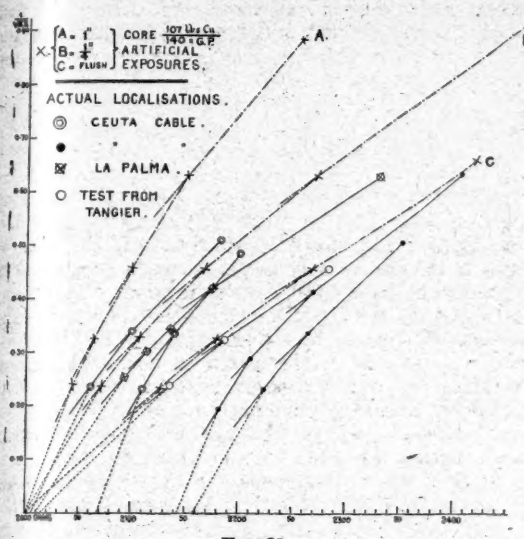


Fig. 38.

rapidly accumulating work that mounts up so quickly on those occasions, is the last man in the world to waste time by using a device he does not like and does not feel at home with. He would jettison it sooner. . . . !

In fact, experience not only on the ships, but also at cable stations, goes to show that once a man adopts graph methods, he becomes so pleased and interested, and finds them such an excellent corroborative check on the style of his testing, and general accuracy of his work, that he wonders he never took to graphs before.

Fig. 38 shows a number of Jona graphs obtained according to the routine explained in connection with fig. 27 of the earlier series.

A B C are check curves—indicated by *cross* plottings—obtained on artificial exposures of core 107 lb. Cu./140 lb. G.P., with the same battery and apparatus as used for the actual localisation tests successfully made on the various cables in need of repair.

The other six curves, with various circular plottings, as shown in the explanatory table included with fig. 38, severally belong to certain definitive localisation tests (to

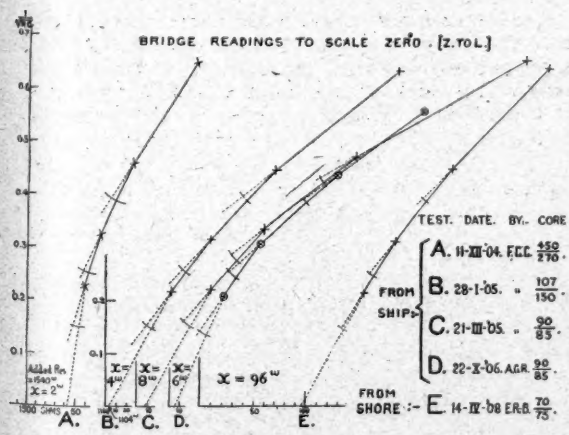


Fig. 39.—Actual Localisation Tests.

breaks) made during repairs on the Ceuta, Tangier and Tenerife-La Palma cables.

All the said tests were made through an inserted extra resistance of 2,000 ohms, which, of course, represents the point of origin of the artificial exposure curves, and which naturally has to be deducted from the various resistances indicated by the cable test curves.

Dotted lines have been drawn in fig. 38 from the several curves as given by scale-zero bridge tests to those points on the line representing resistance up to break, which subsequent recovery of cable from ship's cut-in proved to have been correct.

For example, in fig. 38 the first curve from the right with black plottings, which was a test made from shore, shows the resistance to break to be 2,158-2,000 = 158 ohms from shore—the true result, which almost coincided with that previously estimated on evidence afforded by curve trend.

Having dealt with the foregoing examples more or less *en bloc*, we find similar matter in fig. 39 treated more in detail.

In fig. 39, tests A, B, C, D are all from ship's cuts-in to broken ends, the intervening conductor resistances, as subsequently ascertained on picking up, being severally 2, 4, 8 and 6 ohms, after deduction of the extra resistances added for the adjustment and steadying of the testing currents.

Test E—the only test in fig. 39 made by the writer—was observed from shore, and shows the graph localisation of a fault in an unbroken cable, which not only entirely interrupted telegraphic communication, but gave next to no difference in shore's tests, whether distant end was "free" or "to earth." Notwithstanding the serious nature of this fault, the exterior mechanical condition of the cable at the

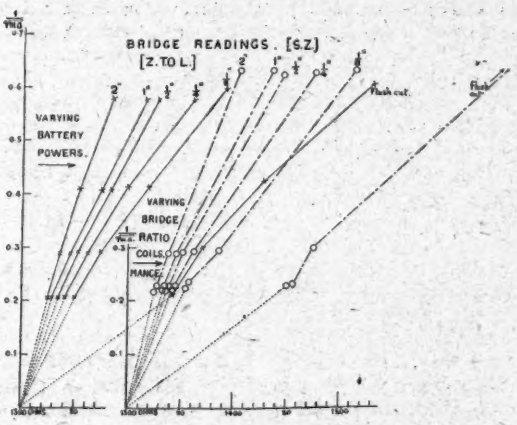


Fig. 40.—Core 70 lb. Cu. / 75 lb. G.P. Artificial Exposures.

fault—on the ship picking up—was found to be normal, excepting for a kink of long standing in which the sheathing wires were intact. The actual fault was found to be a caked-up hole in the gutta-percha, about the size of an average pin's head. This particular example will receive further attention in these articles in connection with Mr. E. S. Heurtley's exposure test. At present it suffices to know that the graph E indicated at approximately 100 ohms, a resistance up to the fault eventually proved to be 96 ohms, after due deduction of the extra inserted resistance—on that occasion 1,162 ohms.

The main object of fig. 39 is to afford examples of C.B. practical working on five different occasions in the hands of three different observers.

Figs. 40 and 41 afford striking instances of the interest attaching to graphs of artificial exposure tests with especial reference to the educational influence these graphs bring to bear on cable-break localisation and problems as to what are the most suitable testing currents to be used on any particular occasion.

Very shortly after the first appearance (in *The Electrician*, of January 21st, 1901) of Mr. E. Jona's "Graphic Method for Calculating the Distance of a Break in a Submarine Cable," the writer derived keen pleasure and many useful lessons from drawing Jona graphs of his various localisation tests of the past, including tests by Sir Henry C. Mance's method.

Some minds assimilate in an instant the inward significance of ornate tabulations of figures and percentages with

an ease envied by the writer who, of more ordinary calibre, greatly prefers *graphs* which afford at a glance an easy and illuminative interpretation of the conditions involved by, perhaps, quite a crowd of resistance and current values.

Figs. 40 and 41, referring respectively to cores 70 Cu./75 G.P. and 400 Cu./360 G.P., each give two sets of curves, one involving varying battery powers as a means for varying the testing currents, the other varying bridge ratios on the Mance principle.

In each series graphs are given for the following copper strand exposures:—2 in., 1 in., ½ in., ¼ in., ⅛ in. and a flush cut, viz., the conductor showing its sectional area flush with the gutta-percha dielectric.

Inspection of these artificial exposure graphs suggests the following reflections;—

1. In the Mance test, under ordinary conditions, bridge readings with bridge ratio 10, 10 serve no purpose, and may easily lead to quite erroneous results.

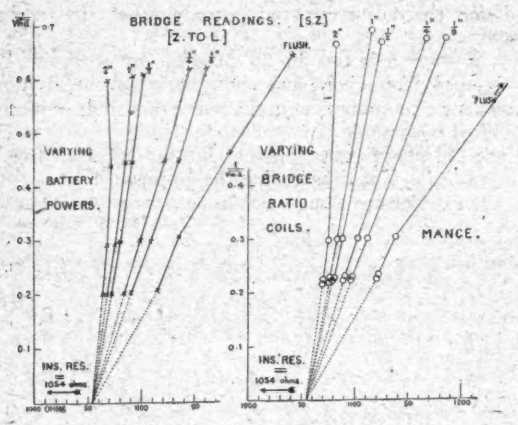


Fig. 41.—Core $\frac{400 \text{ lb. Cu.}}{360 \text{ lb. G.P.}}$ Artificial Exposures.

2. A set of Jona graphs of Mance readings affords useful corroboration of the general trend of the corresponding set obtained with varying battery powers. Take, for instance, fig. 40, which shows tests on 70/75 core. In this diagram the lay of the corresponding curves in the two sets is almost absolutely identical. Take, *e.g.*, the manner in which the 1 in. and ½ in. curves in both sets are in particularly close proximity to each other, or the manner in which the tests on the *flush-cut* exposure evince exactly parallel characteristics of—in this particular case—uselessness as indices of the true resistance up to the break. The reason for this uselessness becomes evident from what now follows.

3. The *flush-cut* curves illustrate graphically a fact which in the early days cable electricians found out by personal experience, namely, that when a lively bridge-balance and great differences in observed resistances due to corresponding changes in current pointed to a *small exposure* at the break, *the only reliable results were to be obtained with quite weak currents*. Fig. 40 shows the *lay* of the *flush-cut* exposure curves to be hopelessly erroneous owing to the heavy polarisation of the small exposure by the use of too strong currents, accompanied by dense agglomeration of high-resistance hydrogen gas bubbles thrown off from the small copper exposure, but tending to cling and greatly increase apparent resistance between the flush-cut copper and water at the circle of contact between the small copper conductor and the surrounding flush surface of gutta-percha.

On the other hand, the portions of the two *flush-cut* curves corresponding to results from the *lower* testing currents (say, from 2 to 6 milli-amperes) if taken by themselves are found to point straight towards 1,800 ohms, viz., the true resistance up to break.

4. A comparison of the small-core curves in fig. 40 with those obtained from the heavy core, as shown in fig. 41, will interest the student.

(To be continued.)

PROCEEDINGS OF INSTITUTIONS.

Production of Iron and Steel by the Electric Smelting Process.

(*Abstract of paper read before the* Iron and Steel Institute, *September*, 1909, *by* E. J. Ljungberg, Falun, Sweden.)

There is at present not much to add to what has already been published concerning the melting of steel by the use of electric current. Furnaces up to a capacity of 15 tons have been built for making special steel with good commercial results, but for making steel of ordinary quality the electric method still seems to be too expensive, even where cheap water-power is available.

At Gysinge, one of the works belonging to the Stora Kopparbergs Bergslag, there is one Kjellin induction furnace with a capacity of 2 tons, but as this is working as a Talbot furnace, not more than about 1 ton at a time is tapped.

The continuous current used in this furnace represents about 200 kw, and the output in 300 days amounts to about 1,200 tons of ingots, using 50 per cent. pig and 50 per cent. scrap. The product is a superior carbon tool steel.

In the electric furnace, as well as in the crucible plant, there are also produced, among different kinds of special steel, high-speed self-hardening steel, tungsten steel, chromium steel, and nickel steel. Such steels can easily be made in electric furnaces when the necessary care is taken. When speaking of high-quality steel, all steel-makers know that the utmost care in heating, hammering, rolling, and tempering is necessary if a good result is to be obtained.

For a country like Sweden, possessing practically no coal mines but numerous waterfalls, the manufacture of iron and steel direct from ore by the agency of the electric current is of much more interest than the melting of pig and scrap to make steel. At the works at Domnarfvet extensive and costly trials have therefore been made in the direct reduction of ore during this and the past few years.

In these experiments two modifications of a furnace constructed by Mr. Wallin in Berlin, and several modifications of a furnace constructed by Messrs. Gröndal & Lindblad (the Electro-Metal Co.), Ludvika, have been tried. Of these it is needless to describe any except the latest form.

The accompanying drawing shows a furnace similar to a common blast-furnace, but with three electrodes fed by three-phase alternating current at about 40 volts, 60 cycles, and 9,500 amperes, averaging 674 h.p, instead of tuyeres. In this furnace, which has been running for 1,903 hours, there has been produced 28 tons of iron, containing from 0·95 to 3·09 per cent. of carbon.

In the manufacture of this quantity there was used:—

Ore	442 tons.
Lime	24 „
Coke	41 „
Charcoal	58 „
Electrodes, total	6·5 „
Electric current	891,623 kw.-hours.

or per metric ton of pig-iron produced:—

Coke and charcoal	353·3 kg.
Power, h.p.-year	0·492
Electrodes effective, 8·8 kg.; wasted ends, 13·9 kg.	22·7 kg.
Pig-iron from ore and lime	60·02 kg.
Pig-iron from ore alone	63·50 kg.
Pig-iron per h.p.-year	2·03 tons.

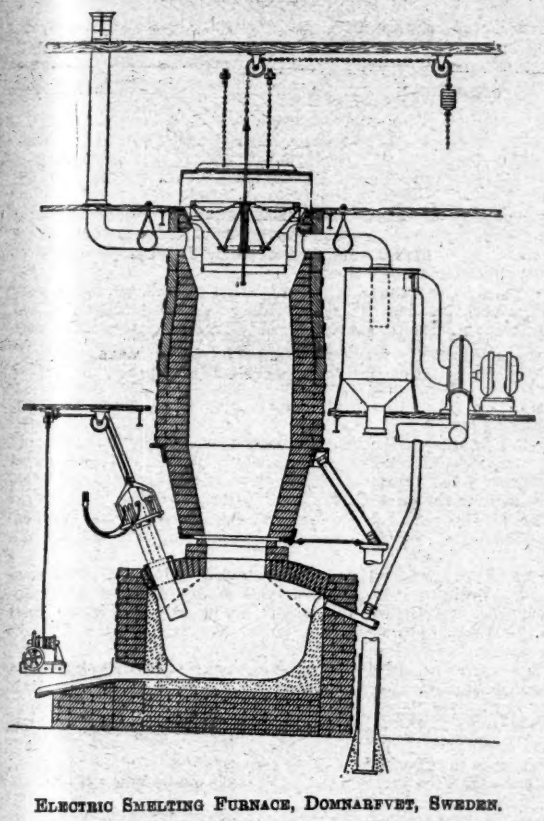
The temperature of the gases escaping from the furnace is generally very low, and they contain on an average about 22 per cent. of carbon dioxide (from 8 to 41 per cent.). The amount of carbon monoxide varies from 39·4 per cent. to 61 per cent. The gases contain practically no nitrogen, but steam from the water in the ore, lime, coke or charcoal is present.

The efficiency of the electric current ought to be higher than hitherto if the considerable loss of heat by cooling water and radiation can be reduced. These losses seem to be about 30 per cent.

No air whatever is used in the process, and the gases are produced from the carbon in the charcoal and coke and the oxygen in the ores ($FeO + C = Fe + CO$). Either charcoal or coke may be used, but the consumption of fuel will be practically the same in either case.

According to the description of the inventor, the figure shows a vertical section through the furnace, which consists of a lower portion, or smelting chamber, corresponding to the hearth of a blast furnace, and a top section or shaft. The latter is supported on columns, which prevent any weight from bearing on the arch of the smelting chamber. The latter is so proportioned as to provide a considerable amount of free space between the charge and the arched roof through which the carbon electrodes project into the charge. The brickwork is thus protected against any very high temperature, and remains a non-conductor of electricity. This is an important feature of this furnace, since experiment has shown that if the electrodes enter the chamber at the point where the charge touches the walls, a very high temperature is generated at this point; the brickwork is destroyed and becomes a conductor of electricity, giving rise to a more or less complete short-circuit. The brickwork may be further cooled by means of a blast of cool gas taken from the top of the furnace and blown in round the electrodes with a fan, no heat being lost by this proceeding.

The ore and fuel are crushed to a suitable size, and are fed into the top of the furnace through the bell hopper in the usual way, the ore being partially reduced by the carbon monoxide rising through the charge. The latter spreads out in the smelting chamber as shown, and the reduction is there completed. Since the electrodes project well into the charge, the highest temperature occurs in the centre of the latter, and the brickwork is thus kept cool compared with the walls of an ordinary blast-furnace.



Electric Smelting Furnace, Domnarfvet, Sweden.

It will be seen from the figures given in the paper that a step has been taken in the direction of replacing a considerable part of the fuel used in making iron and steel by the electric current, and that the problem is technically solved. As regards its commercial value, it is too early to make any definite statement yet, but this will be readily understood by all iron and steel makers when they reflect how many years it has taken to bring the Bessemer, the open-hearth, and the basic processes to their present state of perfection.

The Determination of the Economy of Reversing Rolling Mills.

By C. A. Ablett, B.Sc., A.M.Inst.C.E. (London).

(*Abstract of paper read before the* Iron and Steel Institute, *September*, 1909.)

Since the last autumn meeting of the Iron and Steel Institute, five steel works have decided to adopt electrically-driven reversing rolling mills, making in all over 20 firms who have come to this decision, and twelve such plants are at work in different parts of the world, one at least being installed to replace an engine less than 10 years old, which was in good condition.

The reasons influencing this decision may be briefly summarised as follows:—

1. Greater economy in fuel consumption.
2. Larger output from plant.
3. Reduced running costs—*i.e.*, reduction in cost of repairs, attendance, oil, &c., the reduction in the cost of oil being very striking.
4. Greater convenience and reduction of management expenses due to centralisation of power supply.
5. The great economy of the electrical plant is maintained throughout the life of the plant, and does not diminish as the parts wear.

The capital cost of an electrically-driven reversing-mill is greater than that of a steam-driven mill driven by a plain two-cylinder engine, but in the last two years the experience gained in setting a number of such plants to work has enabled the capital cost to be very materially reduced.

Further reductions in the capital cost are scarcely possible unless some entirely new method of reversing-mill driving is evolved in place of the Ilgner system, which has been employed exclusively up to the present, and the present state of electrical knowledge does not offer much prospect of this.

In a very large number of cases the economies which could be effected by the adoption of electric driving are found to amply justify the increased capital expenditure. At the present time, the question of saving in fuel consumption appeals to most steelmakers as the chief inducement offered by electrical driving, as the possibilities in the direction of greater output are not fully recognised, there being as yet no published figures relating to this. It is therefore of interest to consider the methods by which the economy in fuel, power or steam consumption can be ascertained.

Tests are frequently made to determine the economy of a reversing mill engine, either—

1. By indicating the engine and estimating the steam consumption per indicated horse-power from some of the larger diagrams, or
2. Where boilers can be isolated, by measuring either the feed water or the coal burnt for a considerable period, and keeping a record of the tonnage of steel rolled over that period, so that the result is expressed in pounds of coal or pounds of steam per ton rolled.

In the author's opinion the results of such tests have little value. The steam consumption corresponding to small diagrams is naturally considerably higher per indicated horse-power than that which corresponds to full load, so if the steam consumption was worked out for all the diagrams taken in rolling down an ingot, with a continuous indicator, the average steam consumption per indicated horse-power would be shown to be much higher than if only a few of the larger diagrams were chosen.

No clue is furnished to the losses taking place before the steam comes to the engine stop-valve, which are naturally higher in proportion to the total work done with a reversing-mill engine than with a continuous-running engine, and the losses due to condensation and leakage in the engine cannot be accurately ascertained.

The method of measuring the feed water or coal burnt per ton of steel rolled, which can only be carried out where it is possible to isolate boilers for the purpose, is open to the objection that two entirely different quantities are included in one measurement, *i.e.*, the economy of the engine, and the actual work done in rolling the steel. This prevents any comparison being made between different engines, unless the same sections are being rolled from the same sized ingots under similar conditions in both cases.

Where it is possible to isolate the boilers supplying a reversing mill engine, reliable figures for the steam or fuel consumption can be obtained by making a simultaneous test to determine the actual work required in foot-pounds to roll the ingots, supposing that the same sized ingots are being rolled down to the same section for a number of hours.

If a set of continuous indicator diagrams are taken during the total time that one ingot is being rolled, the combined area of the diagrams reduced to the proper scale, as determined by the steam pressure and the size of cylinders of the engine, gives the total work done on the ingot in foot-pounds. If this quantity be multiplied by the total number of ingots that were rolled while the test was taken and divided by 33,000 and by 60, the amount of work done by the engine during the test in indicated horse-power hours is obtained. If now the weight of coal burnt or feed water consumed be divided by the total horse-power hours as obtained above, the pounds of steam or of coal per indicated horse-power-hour is obtained, without incurring any of the sources of error mentioned above.

It is naturally desirable to take continuous diagrams for a number of ingots while the test is being made, and to take the mean of the results, in order to avoid any chance of an error in the cards for one ingot. The author has usually found that when the total work done is obtained for a number of ingots, rolled under similar conditions, the values obtained agree within 5 per cent.

The above-mentioned tests do not furnish any clue to the mechanical efficiency of the engine, and in the author's opinion the usual method of arriving at this—*i.e.*, taking indicator diagrams when the engine is driving the mill at full speed running light—shows the mechanical losses to be considerably less than they really are when ingots are being rolled, and that this is particularly the case when the engine is geared to the mill.

The energy consumption of an electrically-driven reversing rolling-mill, as expressed in kilowatt-hours per ton rolled, can be determined in the simplest possible manner by inserting an ordinary integrating wattmeter in the supply system.

Results expressed in kilowatt-hours per ton are generally found most useful, as the cost of the kilowatt-hour varies according to local conditions; knowing this cost, the total cost of power can be arrived at directly.

The following figures show some characteristic values for the kilowatt-hours per ton rolled, obtained from tests on reversing mills:—

	Kilowatt-hours per ton.
4½ in. × 4½ in. billets from 2·5-ton ingots. Output, 53 tons per hour	22·5
6 in. × 6 in. blooms from 2·5-ton ingots. Output, 63 tons per hour	17·5
8 in. × 8 in. blooms from 2·5-ton ingots. Output, 80 tons per hour	13·0
12 in. × 9½ in. blooms from 7-ton ingots, measuring 34½ in. × 25 in. Output, 65 tons per hour	11·2
32 in. × 9 in. slabs from 6-ton ingots measuring 36 in. × 19½ in. Output, 40 tons per hour ...	4·3
32 in. × 5 in. slabs from 6-ton ingots measuring 36 in. × 19½ in. Output, 40 tons per hour	5·8
Flange rails, 100 lb. per yard, from 2-ton ingots. Output, 30 tons per hour	48·0
Beams, 120 lb. per yard, from 1·5-ton ingots ...	36·0
Channels, 92 lb. per yard, from 1·5-ton ingots ...	37·0

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Mining Switchboard.

The accompanying illustration, fig. 1, shows a cellular high-pressure switchboard of the Union Electric Co., of Park Street, Southwark, S.E., designed principally for underground mining work where available space is limited, and inaccessibility of live portions of the switchgear essential. The design consists of numbers of cells constructed either of steel framework and sheet-iron, or of artificial stone. The upper portion of these cells contains the busbars and receptacles for the isolating plugs. The circuit connections, which are provided with suitable plug receptacles, are arranged upon porcelain insulators at the back of the cells. For each cell a movable enclosure or switch unit, mounted on wheels, contains the oil-break switch, current and pressure transformers, time relays, signal lamps, and the measuring instruments required, together with the operating lever for the isolating plugs, which are fixed upon suitable insulators and project through the back of the enclosure. The plugs for the circuit connections are arranged in a like manner; these plugs engage with their respective receptacles when the switch unit is pushed into its cell. The action of putting in the isolating plugs automatically locks the movable switch unit in position. The oil-break switch lever is also interlocked with the lever of the isolating plugs, so that the former must be put to the off position before the isolating plugs can be withdrawn.

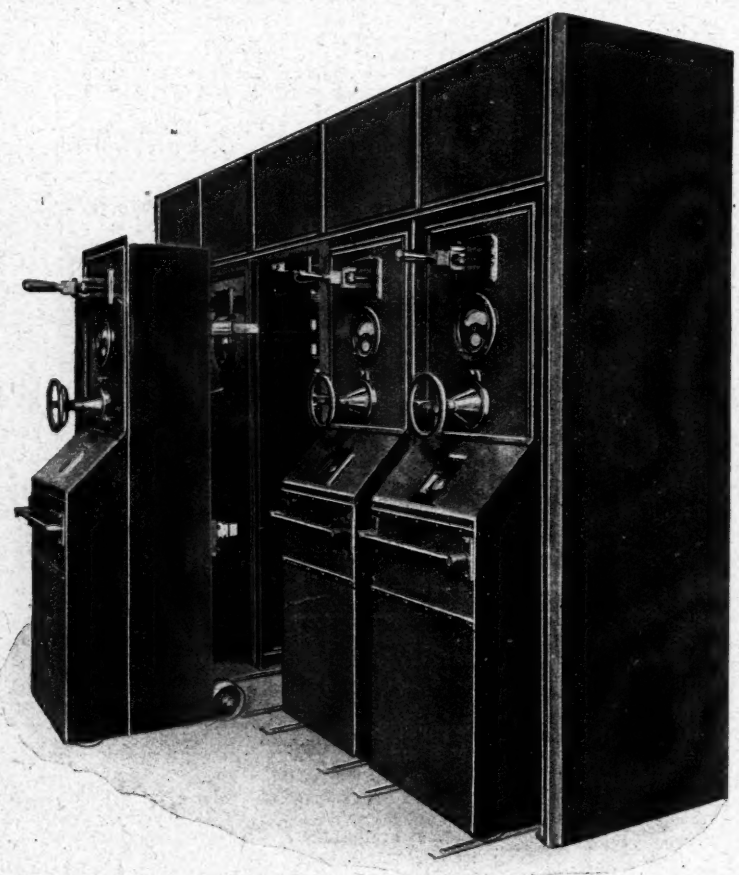


Fig. 1.—Union Electric Co.'s Cellular Mining Switchboard.

The illustration shows a board of this type constructed for two incoming and three outgoing 6,000-volt circuits.

S.M. Electromagnetic Clutch.

Messrs. C. E. Lugard & Co., of Middlesbrough, have put on the market this clutch, which has been in use on the Continent for some time past. It consists of a stationary magnetic body containing a coil, and provided with feet for fixing to a suitable support. The armature is divided into two parts; the driver is fitted with a renewable cone of phosphor bronze or hard fibre (according to the nature of the drive), and the driven part is fitted with an accurately ground cone of steel. Continuous current is supplied to the energising coil, which draws the two parts of the armature together, driving being effected partly by the friction of the cones and partly by magnetism. Between all other faces of the clutch an air gap is maintained, so that sticking from residual magnetism is impossible. The principal advantage of the clutch is that it has no slip rings or brushes, the cable being connected to terminals fixed on the side of the stationary magnetic body.

Some large clutches have been successfully applied to rolling mills using 1,200 H.P. at 350 R.P.M., and 800 H.P. at 215 R.P.M., and they have been running for some time on wire-rod mills, enabling the mill to be stopped instantly from any number of desired points, and providing an automatic safety device against overload.

Reversing clutches have been fitted to large planing machines,

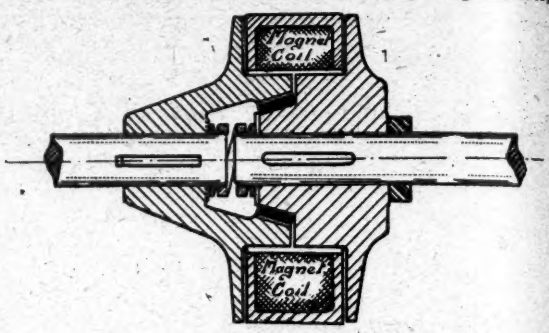


Fig. 2.—Section of S.M. Clutch.

doing away with shifting belts, striking gear, &c.; they are said to be better than reversing motors, because the same speed of cut and return can be maintained for any length of stroke. For shafting, loose pulleys, &c., a very large number have been made.

The clutch is made in 17 standard sizes and 3 types.

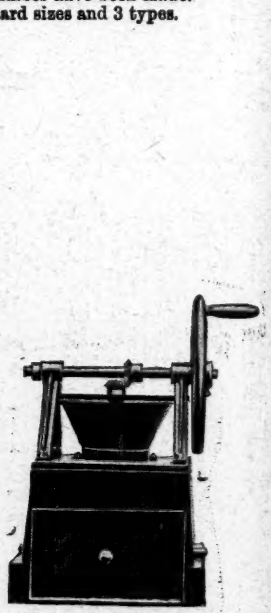


Fig. 3.—Grinding Mill for Samples of Fuel.

Grinding Mill for Samples of Fuel.

The grinding mill illustrated below has been designed specially for crushing samples of coal and slack. The mill is constructed on the coffee mill principle, and consists of (1) a hopper; (2) two ribbed grinding cones, the outer of these being fixed while the inner one is rotated by the spur-wheel on the central shaft; and (3) a receptacle for the crushed sample of fuel.

The mill is strongly built, and the grinding cones are adjustable so that the space between their lower edges, and the fineness of the sample, can be varied at will. The bearings of the horizontal driving shaft are of gun-metal, and a heavy fly-wheel is attached. The smallest size of mill stands 20 in. high, and takes lumps of fuel up to 2½ in. × 1½ in. in superficial dimensions. The hopper holds 8 lb. of fuel; this charge can be passed through and reduced to pass a 16/in. mesh sieve in five minutes, using hand power for driving the mill. With mechanical power, the output can of course be accelerated.

The mill is adapted for crushing down the larger samples of fuel weighing 14-28 lb. obtained in those central stations where fuel sampling is now regularly carried out. Mr. William Barnes, of the St. Oswald Works, Ashbourne, is the maker.

A New Mercury Air-Pump.

An apparatus which is mechanically driven, and which enables an extremely high vacuum to be attained, is described in a recent number of *E.T.Z.* It consists essentially of a bent tube r, half filled with mercury (figs. 4 and 5), ending in two S-shaped extensions b, and connected at its centre point by the straight tube c and a flexible tube p, to the vessel to be exhausted d. The S-shaped ends expand into the tubes f, which are connected by the T-tube t, t and flexible tube l to any ordinary air-pump w. In order to save time, the pressure in d is first reduced to about 10 or 20 mm. of mercury by means of the pump w, setting the tube in the position shown in fig. 4. The apparatus is then set rocking about the axis a, from the position of fig. 4 to that of fig. 5. The mercury retained in the S-shaped extension

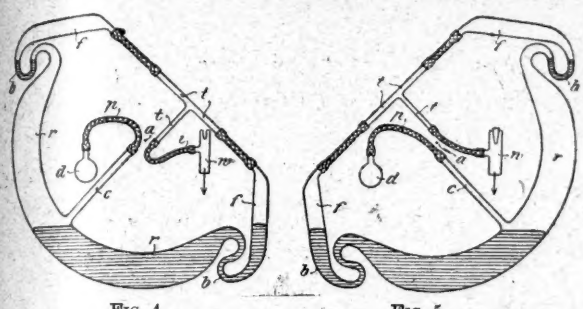


Fig. 4. Fig. 5.

Von Reden Mercury Air Pump.

acts as a valve, preventing the return of air from the tubes f into the main tube r, whilst at the same time the air drawn from the vessel d through c is forced through the S-tubes into the tubes f, and is removed from these by the air-pump w. Fig. 6 shows how the apparatus is mounted. The pump is driven by means of a small turbine.

It is stated that a vacuum of 0·00001 mm. of mercury can be obtained with this pump. The parts can be very easily taken apart and cleaned. The pressure is measured by means of a special kind

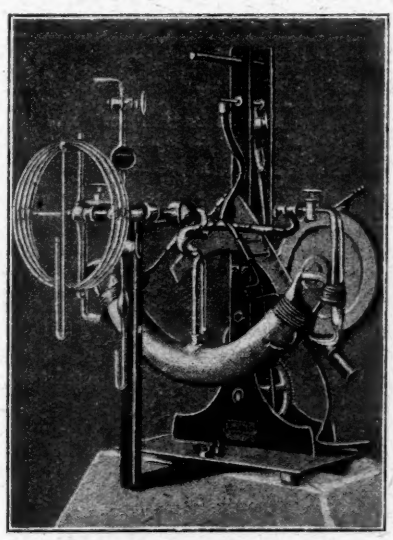
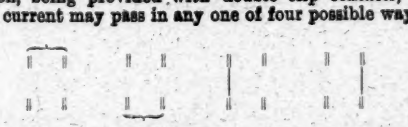


Fig. 6.—Von Roden Pump, Complete.

of Macleod gauge, arranged in the form of a spiral tube, in which a portion of the exhausted space can be cut off by a mercury seal and the gases compressed to $\frac{1}{1000}$ of their original volume, with a corresponding increase in the pressure, which is thus rendered measurable. The pump, which is the invention of Dr. von Reden, is made by the Polyphos-Elektrizitats Ges., of München.

Lundberg "Intermediate" Switch.

Messrs. A. P. Lundberg & Sons, of Pioneer Electrical Works, Islington, have sent us a sample of their new "Intermediate" switch, replacing their present type of "Pivot Intermediate" switch, for controlling lamps from a number of different positions. The switch, which is illustrated in fig. 7, is of very ingenious construction, being provided with double clip contacts, through which the current may pass in any one of four possible ways, thus:



The connections of the intermediate switch are shown on the accompanying diagram, fig. 9, from which it will be seen that the terminals must be connected either crosswise or lengthwise; this is effected by a very cleverly built-up patent rocking contact arm, shown in fig. 8. The arm consists of six brass stampings, insulated with mica, and held firmly together with screws insulated with porcelain bushes, the construction being therefore proof against

Fig. 7.—Lundberg "Intermediate" Switch.

breakdown through overheating or moisture. According to the scheme of connections illustrated, only one pole of the circuit is brought into the switch, so that short-circuiting is impossible. The switch is made in two patterns, for surface and flush work respec-

Fig. 8.—Rocking Contact Arm.

tively; it is interesting to note, too, that by the omission of one of the U-shaped contact arms it can be converted into a series-parallel switch with no "off" position, or if both U-shaped arms are removed, it becomes a double-pole switch. In its normal con-

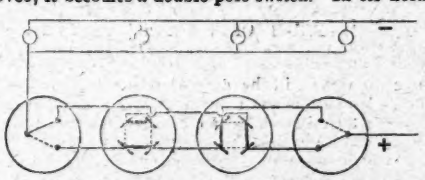


Fig. 9.—Diagram of Connections—Lamps Alight.

dition it makes a reversing switch without "off" position. If used for these purposes, the switch should have a porcelain cover, or the metal cover should be lined with an insulator.

Rolling Heavy Copper Rod.

Our readers will be interested in the accompanying view which was recently received from Messrs. Thomas Bolton & Sons, Ltd. It shows one of the heavy wire rods which this company now roll at their Oakamoor works with the object of dispensing with all

Fig. 10.—Jointless Trolley Wire.

joints of any description in the manufacture of trolley and transmission wires. They are rolled from huge bars of solid copper, some 6 in. square in section, with a length of 9 ft. or more according to the weight required, the coil shown in the illustration being equivalent to about half-a-mile of No. 0000 S.W.G. wire.

We are informed that the method is unique in the copper industry, and is proving very satisfactory from the manufacturers' point of view, while the absence of joints is much appreciated by tramway engineers.

Messrs. Bolton have of late been devoting special attention to the tensile strength of heavy wires, one of Buckton's latest self-registering testing machines being constantly employed on samples of copper destined for trolley wires. An examination of the stress-strain diagrams showed specimens of wires as thick as Nos. 00000 and 000000 S.W.G. having an ultimate strength as high as 25 tons per square inch, with an elongation of 2¾ per cent. to 3 per cent. in 10 in.

New B.T.-H. Motors and Generators (Type D G).

The British Thomson-Houston Co., Ltd., of Rugby, are bringing out a new line of D.C. motors and generators embodying recent improvements. The armatures are of sheet-steel laminations with form-wound coils, and the commutators are forced on and keyed to prevent relative movement; the magnet frames are of cast-iron, with laminated wrought-iron poles, which can be removed with the field-coils without displacing the armature. The end shields can be turned through 90° or 180°, and the bearings are in length three times the diameter of the shaft, and of the self-oiling type. The temperature-rise after six hours' full-load run is

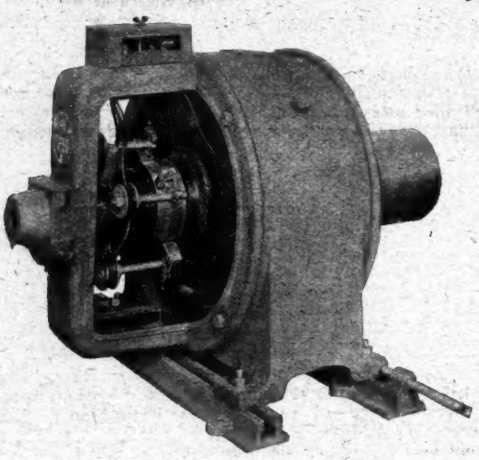


Fig. 11.—B.T.-H. Open Motor (Type D G 8).

specified not to exceed, in the case of protected-type generators, 40° C., and all the motors and generators will stand an overload of 25 per cent. for 30 minutes, or 50 per cent. momentarily. Five types of cover are supplied, ranging from perforated metal to flame-proof; the machines that are equipped with solid covers can be provided with a fan behind the armature, which draws in air at

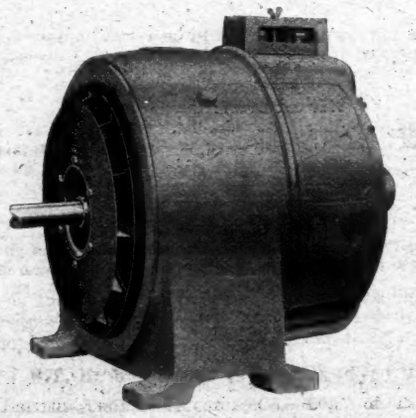


Fig. 12.—D G Totally-Enclosed Motor, with End Shield Removed, showing Fan.

the inside of the commutator end shield and discharges it at the pulley end, so as to obtain the full advantage of an enclosed machine without the reduced rating and increased temperature-rise otherwise necessitated. The machines are rain-proof, and can be made dust-proof. Price-list No. 222 gives full particulars of the series, with dimensions and prices, and the accompanying figures show the appearance of the open and enclosed machines.

Electric Smelting.—According to the *Standard*, the first great electric smelting plant for the treatment of ores to be established in Canada is to be erected at Sault Sainte Marie, Lake Superior. Similar furnaces are now in successful operation in Sweden. A second plant, involving an investment of some $7,000,000, is contemplated at a point on the Ottawa River, and it is confidently expected that this will be followed by many more plants of a similar nature.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Magnetising Current of an Induction Motor.

I have read with much interest "W. D's." most courteous reply, and his explanation of the various losses in an induction motor, and I beg to thank him for the same. I am afraid, however, he has not fully understood the query raised; it was as follows:—

It was found that a certain 10-H.P. slip-ring induction motor gave the following tests:—(1) 200 volts 15 amperes 85 cycles, rotor at a standstill and open-circuited; (2) 200 volts 29 amperes 85 cycles, 1,100 watts, no-load reading.

From the above reading (1) is magnetising current added vectorially to the energy current (which comprises eddies and hysteresis), equals 15 amperes.

Whereas, reading (2) is magnetising current added vectorially to the energy current (which comprises eddies, friction, windage and hysteresis), equals 29 amperes. From (2)—

$$\text{Energy } c = \frac{1.100}{200} = 5{\cdot}5 \text{ amperes};$$

$$\therefore \text{Mag. } c = \sqrt{29^2 - 5{\cdot}5^2} = 28{\cdot}5 \text{ amperes.}$$

From (1) the magnetising current appears to be anything below 15 amperes.

These figures seem to point to the fact that the current taken for magnetising at no-load is different from that taken with rotor open-circuited and at a standstill. Is this the case?

Still Troubled.

Notes on Trade Abroad: Are we Indifferent?

I note in your issue of September 24th that special mention is made of the fact that the Winnipeg electric light plant contract had been obtained by British manufacturers, and the necessity for the British manufacturer to have his representative "right there."

Permit me, as a Canadian engineer, to say that you cannot bring this point home too strongly. With the preferential tariff and present low freight rates the British manufacturer is in a position "to have and to hold" one of the finest markets in the world.

The total indifference of the British manufacturers has been brought home to me from the fact that, in visiting Europe at this time, I tried to interest them in this market by obtaining their representation. To my surprise I have been compelled to go to the Continent, where I have been received with true business zeal, and I am glad to say it will be profitable.

The Canadians are human when it comes to business, and the lowest bidder gets the contract; but in a great many cases our neighbour to the south of us gets the business, because he is "right there" with his business connections, and is not afraid to hustle. Hoping this hint will be beneficial, I beg to remain

A Canadian Engineer.

September 29th, 1909.

A Peculiar Phenomenon.

I encountered rather a curious phenomenon a few days ago, which may interest your readers.

In the generating station here there is a single-phase alternator of the revolving-armature ironless type, made by Siemens Bros. & Co. The alternator is about 10 years old, and has 12 pairs of poles. The 24 field-magnet coils are all connected in series, and the exciting voltage is 100.

By putting one hand on the insulated portion of the winding of one of the field coils on one side of the armature and the other hand similarly on the corresponding coil on the opposite side of the armature, one received quite a severe shock; this was only noticeable on about five out of the 12 pairs of poles. The shock was at first thought to be due in some way to static electricity, but some tests made showed that this was not so.

Finally, it was found that, while a reading of 60 volts was obtained across the terminals of two of the coils in question, between the terminal of one coil and a damp rag placed on the insulated portion of the winding of the opposite coil, 30 volts was obtained, thus showing very considerable leakage through the insulation. The voltmeter used was an electromagnetic one, but as the lowest reading on it was 30 volts, I could not get a proper reading from the insulation of one coil to the insulation of the other. Presumably it would have been about 15 volts.

The insulation on the coil windings is a double cotton covering heavily varnished on the outer layer (where it was touched by the hand), and it was through this cotton covering and varnish that the leakage took place. A fresh coat of varnish eliminated the trouble entirely. The machine was perfectly dry, and the insulation tests were very good both to earth and to the high-tension connections. Apparently through age the varnish and cotton covering had both become comparatively good conductors.

One wonders how long it will be before the turns on the coils become short-circuited in this manner.

Alfred S. L. Barnes.

Electricity Works, Gibraltar,
May 28th, 1909.

Prospects in Chile.

As an engineer who has spent some little time in Chile, I would not recommend "Desalentada" to go out to that country on "spec"; rather would I advise him to inquire of the London offices of some of the big importers and shippers and the nitrate companies for suitable vacancies, and proceed out under contract (under £250 per annum is no use).

Santiago, Valparaiso or Conception have little to offer for the technical man unless he has commercial training and experience to back him up. The best field for making money is in the North, on the "pampas" or nitrate grounds, as good *practical* men are scare here and conditions of living are rather rough and monotonous. Good salaries, with living accommodation, are to be obtained up North; but, again, it is highly desirable to have arrangements made before leaving.

Above all, it is to be thoroughly understood that the language (apparently no obstacle so far as "Desalentada" is concerned, and a useful qualification in pushing his application), the customs of the country and the methods of doing business are all quite different to those of this country, and unless "Desalentada" is possessed of an adaptable temperament he is not likely to remain happy once the novelty of the situation has worn off; far better would he, I think, be advised to "chance his luck" in one of the Colonies, say Australia, where there are plenty of opportunities for an engineer to "make good."

Marshall Tate.

London, S.W., *October 4th*, 1909.

Not Wanted in Australia.

I am afraid "Milli-Volt" is rather too severe on Australia, as, from my own observations, there is plenty of scope and numberless opportunities for the right sort of men (engineers) in that colony, neglecting the factors of Socialistic and, admittedly, poor Government, together with trade union influence and tyranny.

Myself, I landed in Sydney from South America, and within three weeks secured a situation at £4 per week with only *one* testimonial to show (my other papers had been sent home to England direct), and after one month I landed a more suitable billet at £5 per week, with the same recommendations and applying through the daily paper. After having been with this last employer a short time, the whole of the applications came under my notice, and I am bound to say that not one of them possessed any exceptional degree of merit; further, my employer assured me that it was extremely difficult to obtain really good men.

I may have been lucky, but conscientiously believe that any good man holding satisfactory credentials will not long remain unemployed in Australia (pretty well any State), granted that he is energetic and "does not allow the grass to grow under his feet." Outside the larger cities, there are plenty of opportunities for practical engineers "up country," and in the mining districts; should everything else fail, a man need never starve if prepared to accept agricultural employment (unskilled) till a favourable opportunity presents itself of securing work in "his own line."

Lavender Bay.

Coefficient of Self-Induction.

In reply to your reviewer's comments, may we be allowed to express our preference for a technical rather than a dramatic treatment of the matter under discussion, and to press for a definite reply on the point at issue.

Referring to the case of a coil which has an iron core and carries an alternating current, and admitting the definition of the coefficient of self-induction as quoted by your reviewer, we would ask him to tell us in plain language:—

1. Whether, in his opinion, the definition of the coefficient of self-induction involves the relation between the current in the coil and the flux it produces.

2. Whether, in his opinion, the relation between the current in the coil and the flux it produces as represented in a vector equation, involves the use of a complex number or not.

We may point out that, so far as we are aware, there has been no difference of opinion in this correspondence as to the *numerical value* of the coefficient of self-induction; and therefore the question whether such a quantity is easy or difficult to calculate would seem to be entirely irrelevant.

We have never suggested that the numerical relation between current and flux was other than a rational number, and the last lines of your reviewer's observations seem to indicate that he, too, has arrived at this rather obvious conclusion.

C. F. Smith.
William Cramp.

Manchester, *October 4th*, 1909.

Electric Laundry Irons with Indicators.

Referring to your Adelaide correspondent's letter on the above matter, about 15 months ago I installed an iron in our tailor's shop, with a 5-c.p. lamp in parallel, in a position visible to all users, to serve as an indicator.

I certainly think it is essential that an indicator of some description should be provided; and as a lamp is the most visible, as well as most simple, to understand, I think it may be considered the most satisfactory type of indicator; the current consumed is small, and the saving great when one considers how easily an iron could be left on if no indicator was provided, especially when the iron may be used intermittently.

Of course, the lamp gives a certain amount of light, but I do not think a supplier of current would raise any objection when he understood the purpose for which it was used. If he did object, what would be his opinion regarding a glow lamp radiator? Anyhow, if objection was raised, a coloured lamp could be used.

From my own practical experience, I think an indicator is necessary for several reasons, and would strongly recommend the extended use of the same.

A. W. Wyatt.

Cornwall County Asylum, Bodmin.
October 4th, 1909.

Tramway Power Tariffs.

It is somewhat surprising to find from your comments on my last letter, that you are still unconvinced as to the wisdom of Manchester's adoption of a combined system for lighting and traction. The opinion of the Manchester Tramway Committee and their manager, arrived at after protracted discussion, evidently counts for nothing, although they are, of necessity, the best acquainted with the actual conditions obtaining in this city.

Coming to the fresh matter which you submit in support of your case, the original matter being now, I submit, discredited, is it not grossly unfair to compare separate with combined systems when the figures used are not on a common basis?

It is farcical to say that the figures are "not strictly comparable." To make a comparison worthy of the name, they

require sweeping adjustments. For instance, in a former issue, you agreed to the correction of the Glasgow units from 27,443,493 to 24,707,760 in order to put Manchester and Glasgow on equality, yet you repeat the error in a magnified form by quoting, from Mr. Slattery's tables, Glasgow's total as 29,150,391. Again, Sheffield's cost, as I have shown in my previous letter, is merely the cost of gross output, and does not compare with cases where sales of energy are made to tramway committees direct on the traction routes. This objection applies to all the figures in Mr. Slattery's second table. The comparison in this respect is almost as absurd as that between the cost of coal at the pitmouth in Northumberland and the cost of the same coal delivered to the consumer in London.

I would point out also in the first table that until actual figures are given for the outlay borne by the electricity departments in providing the feeder cables and distribution system generally, together with the annual costs involved in their maintenance, it is quite useless to attempt to make any intelligent comparison.

One notes in passing that Belfast and Cardiff are given as examples of undertakings owning their own stations. According to Garcke, the Belfast tramway "generating station is an extension of the lighting station, and the plant is designed for lighting or traction supply," but I believe I am correct in stating that the whole of the capital incidental to the feeder cable system was found by the tramways department. At Cardiff the tramway power station gives a bulk supply to the lighting department. Further evidence of the inaccuracy of the tables can be found again in the case of Belfast, where establishment and capital charges are shown at the absurd figure of ·13d. per unit against Glasgow's figure of ·738d., Sheffield's ·274d., Birkenhead's ·297d., Leeds ·409d., and so on. From Belfast's own accounts the capital charges alone amount to ·28d. per unit of gross output. I consider that the most serious flaw in the tables is the varying treatment of depreciation, which is quite sufficient to render Mr. Slattery's tabulation valueless. Take Leeds policy, for instance. According to the *Electrical Times*, Leeds, in the year 1908, restricted the provision for renewals and depreciation to the actual sum expended on renewals. But this is not all. The funds that had previously been accumulated for these purposes were distributed and the whole sum passed over to the City rate. At that date Leeds then enjoyed the unenviable distinction of being without any reserve fund whatever. What is the use of comparing such a case with Glasgow and Manchester? The tables are, in fact, useless and downright misleading.

As to my comparison of Glasgow and Manchester costs, I need do no more than refer to the unexpected but welcome entry into this discussion by the *Electrical Times* in its article on the 24th ult. Whatever may be said as to my bias, nothing can be urged against your contemporary. Allow me to quote from the article :—

Manchester.	Glasgow.
The tramways department paid 1·14d. per unit for energy bought from the electricity department.	It cost the tramways department 1·17d. per unit to generate its own energy.

So far the position between us is that originally you made a scathing criticism of Manchester, then when pressed you made important qualifications, and finally you say you cannot agree with the writer of this letter. As this is to be my last contribution to the discussion, I submit that in fairness you ought either to have proved your case or withdrawn it, as the issue at stake is not personal, but is that of settling or unsettling the minds of those Tramways Committees who are purchasing their supplies.

S. L. Pearce.

Manchester, *October 4th*, 1909.

[We regret that Mr. Pearce should have construed our original leader into an attack upon Manchester; this was certainly not intended, and, we venture to think, the complete article could hardly be so interpreted. The Manchester-Glasgow comparison was, obviously, only a side issue, and in view of the importance of the question as a whole, and the attention which is being given to it by municipal tramway authorities and engineers, we cannot but feel that our reference to the matter was timely. As regards the merits of the question as a whole, our only desire is to arrive at the truth, whether it be in accordance with our expressed opinions or the contrary. Mr. Pearce, quite naturally, holds a brief for the combined station; and while we are not convinced by his arguments, we cannot but admire the ability and resource with which he supports his case.—Eds. E.R.]

Unemployment.

In reference to the letter by "Status" in this week's issue *re* Proposed Engineers' Association, I repeat, the matter has dropped as regards station engineers, for it appears that the society which took the matter up wants to assist chiefly consulting engineers and contractors in the preparation of specifications and contracts, with legal advice on such matters. The work of organising the assistant engineers in the electric supply business has been put in the background, whereas this was the chief aim of the correspondence. The letter by "Organiser" corroborates what I say, and I am still of opinion, as I was at first, that if we have a society at all, we must have a new one altogether, unless the present society can see its way to hurry up and place the work of organisation in the front absolutely; the other things can very well wait. We have been waiting nearly two years now, and during this time money might have been coming in.

Electricity Supply.

As a constant reader of your unique paper I would like, from both experience and observation, to point out three great causes of unemployment :—

1. The "family plate" money around which every trade centres.
2. A glutted market.
3. Want of combination.

One writer truthfully and frankly stated that mansion or estate plants offer the bottom prices for mental and manual work, viz., run a gas or oil engine and dynamo, repair all lights and engine, shoe the horses, milk the cows, give massage to master and visitors without tips, dig up the spuds, and fill in spare time with Mary and the lambs in the garden, and sacred duties on Sundays, for the insulting stipend of 25s. per week.

The cause of this is largely the fault of engineers generally; when the infant electricity arrived we shut the door against it, and others picked it up, and so it fell into amateur laps instead of being embraced as an impetus to our fading engineering trade and a branch of its tree.

This new and grand industry has drifted, and this leads me to the cause of the glutted market.

The Polytechnics opened for a mercenary purpose evening classes and workshops, and in these electrical workshops we find clerks, butchers, grocers, drapers, and some of all grades, who, by paying the fees, can pick up the electrical trade like the pigeon picks up peas, rather promiscuously. These classes are a delightful recreation after a full day of chopping up pork, tearing calico, and washing currants. After a few lessons quite a colony of these men leave their own trade and try to pose as electricians; but the workshops are the testing houses, as good mechanics and electricians are watching these robbers, and laughing as they drill a $\frac{5}{8}$ hole in their brass with the back gear in, and file like the village blacksmith.

And the same spirit is prevalent amongst our local tradesmen, making it common for every ironmonger to complete his circulars with the title of electrician, bells fitted, cranks, and otherwise—*stress on the cranks.*

The last cause is the want of combination.

If men have served a lawful five years, let them anon learn the lesson "Unity is strength," and join their brothers in fighting for a living wage, and if out of work, certain bread and cheese; if sick, sick pay; and if on the rocks, a benevolent grant—by joining the Amalgamated Society of Engineers (Electrical Section).

To-day we must give credit to Trade Unionists for a living wage, and value the services and sacrifices of past heroes.

John Burns once visited an asylum, and during his usual inspection, he was warned to keep his eye lifted. He laughed heartily, and replied: "No need for that, as lunatics never combine."

The title of electrician belongs only to the man who has

served his time to the electrical trade, and not only knows the theory, but can do his own repairs, and not to the man who has bits of many trades like the street instrumentalist who plays two instruments with his foot, four with a nod of the head, and the tune that brings most coppers to the drum.

Let all those brothers who have served their apprenticeship and are out of work join the electrical section on the first chance, and keep out the invader and intruder.

All free traders believe in this bit of protection, as it would guard our savings from the robber.

I may differ from my other colleagues, as I am not ashamed of the name that my godfather and mother gave me.

Wm. Podmore,
Electrical fitter.

Sheerness-on-Sea, *October 4th*, 1909.

Correction.—In our reply to Mr. James Gordon's letter, on page 530 of our last issue, we were made by the printer to say that we had said something that we did not say. For the word "no" in line 13, of course, read "any." We don't know how the printer made such a mistake, nor does he, but he really admits that he did it.—Eds. E.R.

BUSINESS NOTES.

The European Aluminium Trade.—It has hitherto been impossible to form a syndicate of the French makers of aluminium such as has been projected for some time past, and which would probably pave the way towards the re-establishment of the international combination that was dissolved a year or two ago. The French makers in anticipation of the creation of the national syndicate concluded a kind of price convention for 1910 a little time ago, but as the syndicate has not been constituted some of the producers insist that the price convention should be determined. However, there is still hope that an understanding will be reached. In the meantime the Société Electro-Métallurgique de Froges has fixed the price of aluminium rolled plates at 2 fr. per kilogramme, and at 2 fr. 10 centimes for wire bars, sheets and wire being on a higher basis.

Consular Notes.—Venezuela. — The British Vice-Consul at Caracas, in a recent report, states that during the years 1907 and 1908 the Central Railway Co. electrified the first 6¼ miles of their line, and they are now extending the road as far as Santa Lucia, a village deriving the little importance it possesses from its situation at the head of the fertile valley of the Tuy River, which should make it a transport centre for the products of that district. The tramway system of Caracas has been electrified, and Caracas now enjoys the advantages of an excellent tramway service. The work was carried out by a London firm, and the system used is a trolley one. The telephone system of the Venezuela Telephone and Electrical Appliances Co., a British owned concern, has been converted to the common battery system, and thoroughly up-to-date plant has been installed, so that Caracas also possesses a telephone system worthy of many a larger town.

Brazil.—The British Consul at Pernambuco reports that over and over again he has laid stress on the desirability of the employment by British exporters of suitably and properly qualified representatives to push trade. Personality counts for very much with the Brazilians, and the representative who will take the trouble to learn the language thoroughly, to understand the Brazilian, and to be sympathetic with him, will constantly score in competition. Apart from the difference to his own personal comfort in his dealings, it will materially affect the interests of those whom he represents. Of course, this means time to gain experience, and to learn to avoid as many of the difficulties with Custom House authorities as is reasonably possible. It would seem that different rates on the same goods are levied in different ports along the Brazilian coast. Apparently different interpretations are made of the same regulations in different places.

Chile.—The British Consul at Valparaiso reports, for the information of those persons who may have to do business with Chile, that care should be taken to have all documents, such as contracts, powers of attorney, &c., legalised by a Chilian Consul before sending them to Chile. Much time and trouble will be saved by so doing. The Consul states that it is satisfactory to see that British merchants have at last realised the importance of sending out their catalogues and price lists in the language of the country. Some of the catalogues which have recently been delivered at the Consulate have been most carefully got up, and should repay the senders for the time and money they must have expended on their compilation.

Ecuador.—The British Consul at Guayaquil reports that rubber gave 12 per cent. less in 1908 than in 1907. Reports as to the plantations are very discouraging. Trees grow badly and reach only a very small size, with little vitality after 10 to 12 years. Those tapped for rubber give 8 to 16 oz. of gum, and most of them after this production are found to be exhausted and die out. The cause of this is yet to be discovered.

Siam.—The British Consul at Patani, in a recent report, calls the attention of persons interested in rubber to the possibilities of that district as a rubber-producing country. The only foreign-owned rubber plantation in Patani is near Bangara. It is owned by an Englishman, and was started about four years ago. Reports with regard to it are very favourable.

Long Life to Metfil.—The Edison and Swan United Electric Light Co., Ltd., of 36, Queen Street, E.C., inform us that they have just received a letter from a satisfied customer to say that one of their 32-c.p., 100-volt Metfil lamps has failed, after burning for 5,880 hours. The depreciation thus amounted to 1d. per 160 hours.

East London Electrical Exhibition.—At the invitation of Mr. C. Newton Russell, electrical engineer to the Borough of Shoreditch, a meeting of exhibitors was held at the Electricity Offices, Coronet Street, Hoxton, on September 30th, when the following committee was appointed:—Mr. F. Pooley, chairman; Mr. H. Harrison, vice-chairman; Messrs. E. P. Barfield, T. Lambie, S. Rentell, and H. Dixon; the last-named, whose address is 11, Victoria Street, Westminster, S.W., being secretary. It was announced at the meeting that nearly all the available space had been taken up. Any further applications for space should be sent at once to Mr. Russell. The secretary of the Exhibitors' Committee invites suggestions, &c., which exhibitors may wish to have brought before the Committee.

Book Notices.—We have received a copy of No. 2 of *Country and Town*, a new 6d. monthly illustrated journal devoted to the beauties of art in country and town. It is edited by Mr. Cecil Alexander Sharp, and bears evidence of the exercise of a wise discrimination in the selection of matter to interest everybody rather than to appeal only to a limited circle who are already catered for by other and technical publications. The contents are somewhat distant from our own province, but we have no doubt that a number of our own readers will be pleased to study this, the October number, with its finely executed coloured plate and statuary group, its charming views of "Our Villages and their Churches," with appropriate notes thereon, and its articles on "A Lake District Garden," "Old English Porcelain," "Leadwork at Haddon Hall," "The Priory Church of St. Bartholomew the Great, Smithfield," "Country Homes," and a variety of smaller items relating to country and town matters coming within the wide sphere of operations covered by the subjects which these titles indicate. *Country and Town*, which has our good wishes for a successful run, is published by the Abbey Press, of 13 and 14, Tothill Street, Westminster.

The *Agricultural Economist and Horticultural Review*, a copy of the October issue of which has been received, is edited by Mr. Greening, of "One and All" fame, and it contains a variety of interesting matters more or less entertaining to the gardener. More than that we need hardly say, nor have we space to spare to do so.

"Transactions of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXV, Part 9. September, 1909. London and Newcastle-upon-Tyne: Andrew Reid & Co.

"Mechanics' and Machinists' Pocket-Book and Diary, 1910." By W. H. Fowler. Manchester: Scientific Publishing Co. Price 6d. net.

"Alternating-Current Motors." By A. S. McAllister. Third edition. New York: McGraw-Hill Book Co. 1909.

"Science Abstracts," Sections A and B. Vol. 12, Part 9; September, 1909. London: E. & F. N. Spon. Price 1s. 6d. each section.

"The Dynamo." By C. C. Hawkins and F. Wallis. In two volumes. London: Whittaker & Co. Price 21s. net.

"Electric Traction on Railways." By P. Dawson. London: *Electrician* Printing and Publishing Co. 1909. Price 25s. net.

"British Standard Specification for Ammeters and Voltmeters." London: Crosby Lockwood & Son. Price 2s. 6d. net.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXV, No. 7. September, 1909. New York: The Society.

Catalogues and Lists.—Messrs. E.M.F., Ltd., 10, Ironmonger Lane, Cheapside, E.C.—A collection of illustrated leaflets relating to their various lines of manufactures, including E.M.F. auto-transformers, metal-filament lamps, luminous radiators, lighting fittings for shop, mill, colliery and other service, ceiling roses, lamp-holders, dry cells, shades and reflectors, bells and bell indicators, wood blocks, and Newall's anti-vibrator for use with metal-filament lamps. The firm has also issued an effective show-card, for distribution to lighting consumers, emphasising the economical and illuminating qualities of the E.M.F. metal-filament lamps.

The Endolithic Manufacturing Co., Ltd., 61½, Fore Street, E.C.—Illustrated sheet of ivory, ivorine, metal or bone name labels such as they make for electrical engineers for attaching to switchboard work and electrical apparatus, batteries, machinery, &c.

Messrs. J. Dugdill & Co., Failsworth, near Manchester.—Set of illustrated sheets showing their adjustable arm electric light fittings and other manufactures.

Messrs. Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—New 16-page pamphlet, containing a clearly-arranged partial list of installations of the "Sirocco" mine fans in use in Great Britain.

Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston.—New price folder dealing with tantalum lamps. We understand that many thousands of these lists have been supplied to electrical

contractors and ironmongers with their own name and address. The firm will readily supply a quantity free to any electrical dealer who applies for them. From Messrs. Siemens we have also received a catching picture postcard, the effect of which is to stick right in the recipient's mind that if tantalums be used he can have "a brilliant passage." We do not like to commence to explain exactly what that means, but if any of our readers who have not received a copy will write for one they will catch Mr. Hassall's humour. Only a block of the card could adequately convey what was in his mind, and unfortunately we have not room for that. The design is executed in colour as a showcard for ironmongers and electricians to display in their establishments, to aid them in educating the public regarding the brilliant illuminating qualities of the lamps.

The Reason Manufacturing Co., Ltd., Brighton.—New pamphlet catalogue of 32 pages, wherein they give particulars, illustrations and tabulated sizes and prices, of their many fuse-boxes, and sealing troughs for same. The list is brought right up to date.

The Dowsing Radiant Heat Co., Ltd., 24, Budge Row, London, E.C.—New price list of electric radiators. A number of new types are being introduced this season in Adams, Flemish, Georgian, Sheraton, Tudor and other designs. Convector radiators and a combined luminous and non-luminous type are also being supplied.

Messrs. Kynoch, Ltd., Birmingham.—Leaflets illustrating, briefly describing and pointing out the advantages, of their self-oiling bearings and their roller-bearing and non-adjustable swivel pedestal.

The Union Electric Co., Ltd., Park Street, Southwark, London.—List No. 8,015, describing their insulation-testing set for contractors and mine electricians.

Messrs. Mavor & Coulson, Ltd., Glasgow.—October date-card relating to Pick-Quick bar coal-cutters, giving notes on undercutting and overcutting.

Messrs. Walter's Electrical Manufacturing Co., Ltd., Kensal Road, London, W.—Twenty-four page booklet containing a number of photographic views of their works, exterior and interior, the latter showing the test room, main instrument shop, wood-working shops, and the casting shop and battery making room. Alternate pages show a selection of the firm's specialities in electrical and telegraph instruments. An accompanying list gives a full account of Moore & Powles' patent one wire three indication block instrument.

Messrs. Tredegar & Co., 56, Victoria Street, London, S.W.—Seventy-six page catalogue (on art paper throughout) showing some of their wooden electric light fittings. A very fine collection is brought together, including a variety of attractive designs of fittings such as brackets, electroliers, standards, pendants, &c., in oak, gilt, white gilt finish, Gesso work, inlaid and carved mahogany.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—Another new pamphlet, No. 16 A (20 pages), has been issued. It relates to the Peebles polyphase induction motors, which are manufactured in all the usual types to conform to the Home Office and Fire Insurance Rules. A type of motor specially suitable for use in textile mills is being made. Sets of weights and dimensions are given for all sizes listed, also particulars of outputs, efficiencies, power factors, &c, for both 50 and 25-cycle circuits at all the usual speeds. A few excellent half-tones appear of the latest types of machines.

Messrs. J. Hodgkinson, Ltd., Queen Anne's Chambers, Westminster, London.—Four-page circular describing their patent coking stoker and self-cleaning fire-bars, and showing a view of five 8-ft. diameter Lancashire boilers fitted with these stokers, also one of 16 similarly fitted boilers of 9 ft. diameter at the Salford electric power station.

The Davis Electrical Co., Ltd, 17, Moor Street, W.C.—Folding card stating prices of metal-filament lamps.

The Ransome-Veb Mehr Machinery Co., Caxton House, Westminster, London.—90-page illustrated catalogue containing full description and data regarding the Ransome concrete mixer (manufactured by Ransome & Rapier, Ltd., at Ipswich). The information given includes particulars of mixers complete with electric motor, starters, and switches, or for belt or steam driving, or with paraffin or petrol engine, also shipping particulars, working capacities, and code-words. Mixers with hoisting apparatus and elevating hoppers are likewise included. Erection and working instructions are given, and particulars are set forth of other concrete mixing machinery. Many pages are occupied with testimonials from contractors who have used the Ransome plant, and photographs of the jobs on which it was employed. One of these pictures shows the mixer at work on the alterations and additions at Dale End generating station, Birmingham. Numerous line drawings with dimensions appear, of belt, engine and boiler, and motor drive general arrangements. The catalogue is a most useful production, and should be interesting to contracting firms having requirements for concrete-mixing in connection with their operations.

Messrs. Marion & Co., Ltd., 22-25, Soho Square, London, W.—Twenty-page pamphlet illustrating and giving prices of a number of their electrical manufactures, including Boardman's photo arc lamps, "N.C.C." carbons, resistances, light diffusers and reflectors, "Westminster" enclosed photo arc lamps, and "Cooper-Hewitt" mercury vapour outfits.

Messrs. Laidler, Ritchie & Co., Ltd, Nutsford Vale Works, Longsight, Manchester.—Priced leaflets of "Meteor" metallic-filament lamps and of Fludor solder.

The Empire Engineering Co., Caxton House, Westminster, S.W.—Small booklet containing information relating to the "Empire" petrol or gas engine for country house electrical installations and other purposes.

Messrs. Ozonair, Ltd., 94, Victoria Street, Westminster, S.W.—A new catalogue of the now well-known "Ozonair" apparatus has just been issued, in which the various types are well set out with illustrations always facing descriptive matter. In each case the description is accompanied with code-words and particulars of the capacity and the amount of energy consumed. All converters are now supplied with ball bearings, enabling them to run for many months without attention. Among the various new types introduced in this list is a complete installation on a small scale all ready for fixing by the ordinary wireman. A new combined self-contained apparatus for disinfection purposes, &c., is also described, and a code index occupies the last page.

Smoke Nuisance Charge Breaks Down.—The City of London Electric Lighting Co., Ltd., were summoned by the Southwark Borough Council for smoke nuisance at their Bankside premises. Owing to dissatisfaction with the manner of serving the notices, Mr. Baggallay dismissed the summonses and allowed the company five guineas costs.

American-German Patents Treaty.—The new treaty between the United States and Germany, which came into force on August 1st, provides that the working of a patent in the territory of one of the contracting parties shall be regarded as equivalent to its working in that of the other; previously an American patent not worked in Germany within three years was liable to revocation if an action was brought with that object in view.

Bankruptcy Proceedings.—In Tuesday's *London Gazette* the following entry appears under "Notice of day appointed for proceeding with public examination adjourned *sine die*":—Harness, Cornelius Bennett, Claregate, Little Heath, Potter's Bar, of no occupation, Court, St. Albans. Date fixed for proceeding with examination, October 26th, 10.30 a.m., at the Court House, St. Albans."

Liquidation.—Mexican Power-Development Syndicate, Ltd.—A meeting is to be held at Basildon House, Moorgate Street, E.C., on November 8th, to hear an account of the winding-up from Mr. A. W. Tait, liquidator.

Electro-Chemistry in Mexico.—A company has been granted a concession to establish a factory for producing carbide of calcium, cyanide of potassium, caustic potash, caustic soda and chloride of lime in Mexico; the company undertakes to invest about £20,000 in the enterprise. The concession is for a period of ten years. The company may import free of duty all machinery and apparatus, building materials, &c., necessary for the construction of the factory and for the manufacture of the chemicals. —*Board of Trade Journal.*

British Patents in Australia.—Following the lead of the British Patents Act of 1907, the Australian Commonwealth Senate has passed an amendment to the Patent Acts for the compulsory manufacture of all patents in the Commonwealth. It is generally considered that this compulsory clause must seriously affect British owners of Australian patents. The Patents, Trade Marks and Designs section of the London Chamber of Commerce has passed a resolution urging that the Chamber should approach the British and Commonwealth Governments by deputation, to urge the introduction of a clause in the Bill to grant reciprocally exemption from the compulsory working of British patents in Australia and Australian patents in the United Kingdom.—*Standard.*

New Zealand.—A decision has recently been given by the New Zealand Customs authorities to the effect that "electrical appliances, viz., medical transformer, consisting of transformer coil, rheostat, and switch," are dutiable at the rate of 30 per cent. *ad valorem* in the case of foreign goods, and 20 per cent. on British manufactures.

Electric Steel.—The *Electrical World* states that the Slatons Works, in the Ural district, are about to install an electric induction furnace for steel manufacture, supplied by Messrs. Siemens & Halske.

Hampstead Electrical Exhibition.—An exhibition of electrical domestic appliances was opened on Wednesday at the Public Baths, Finchley Road, the official ceremony being performed by the Mayoress of Hampstead. The exhibition is to remain open until to-morrow, (Saturday) night, so that any electrical men interested have to-day and to-morrow (between 11 a.m. and 10 p.m.) to see the latest novelties in electrical appliances that are shown, some of them, it is stated, for the first time. From the list of exhibits and exhibitors appearing in the catalogue before us, we gather that electric heating and cooking apparatus will be very strongly displayed, while sunbaths, electric signs, flashers, fans, motors, electric vacuum cleaners, the Siemens "O.S." wiring system, and the Eddystone system of surface wiring are all represented. "XL" stoves, Phœnix apparatus, "Tricity" cookers, Dowsing, Adnil, Stellite, Boyd, Ediswan, Archer (G.E.C.), Bastian, Le Radiant, and Calux electric heating apparatus are a number of the special lines on view. We hope that the exhibition will be an unqualified success, bringing on an excellent increase of both heating and lighting custom.

Trade Announcement.—The address of the Holophane Glass Co. has been changed from 146a, Queen Victoria Street, London, E.C., to 12, Carteret Street, Westminster, London, S.W.

LIGHTING and POWER NOTES.

Bearpark (Co. Durham).—The P.C. has accepted the offer of Mr. Holliday to erect an overhead line for public lighting in Broom Lane at £40, and to provide a supply for 10 25-c.p. lamps.

Beckenham.—The U.D.C. has referred to a Committee for consideration, a scheme of free wiring and the supply of electricity for a fixed sum per lamp per annum, and also the question of tendering for the lighting of the parish of Shortlands.

Bridlington.—The T.C. has applied to the L.G.B. for a loan of £3,000 for electricity purposes, including the provision of a new engine and generator.

Brighton.—In order to meet a prospective increased demand for electric power at the Brighton locomotive and carriage works, the Electricity Committee proposes to expend £2,850 in laying an additional feeder cable.

Burslem.—The T.C. has received from the L.G.B. sanction to a loan of £7,535 for extensions to the electricity works.

Camborne.—The T.C. having rejected the tender of the Gas Co. for lighting the village of Knave-go-by, has asked the Electric Supply Co. to quote terms.

Canada.—The Attorney-General of Ontario has refused to grant a fiat authorising an application to the law courts for an injunction to restrain the Hydro-Electric Commission from carrying out its contract with the Ontario Power Co. This is regarded as ending the controversy as to the Ontario Government's policy in this matter.

Continental Notes.—Switzerland.—The Bernese Hydro-Electrical Co. has presented a petition to the Council of Berne asking for a concession of water power on the Aar, and its tributaries from Meiringen to Grinsel. The company has already purchased what it considered the key to the position in some property of Handegg for a half million francs. The river Aar has for some time attracted the attention of engineers, and with the enormous quantity of water available it is estimated that the present scheme will provide 120,000 to 150,000 h.p. at Innerlkirchen, but four supplementary stations will also be established, one at Guttannen, where a fall of 90 metres is available; those of Engsten, of Gadnen and of Urbach are less important, and during the winter months will, it is estimated, be capable of generating 5,400 h.p.

There is about 250,000 h.p. already utilised in Switzerland, and it is calculated that a further 750,000 h.p. at least is available in connection with the various waterfalls. In many of the Cantons the local government is retaining the ownership of all the public rivers and lakes. The price of electrical energy generated varies according to the method of consumption; where meters are used the price is usually below 9 centimes per hectowatt-hour; where sold for power, an annual sum of 105 lire to 335 lire is paid for the use of each horse-power for 3,000 hours per annum. There is a tax per horse-power of one lire per annum for any fall up to 100 h.p., of two lire from 100 to 500, and of three lire for everything above 500 h.p.

Servia.—The Austro-Hungarian Consul at Belgrade states that the communal authorities of Velké Hradiste have applied for powers to build a large electrical works for the needs of the district.

France.—La Société Centrale d'Industrie Electrique is the title of a new company which is being formed in Paris with a capital of £200,000 to establish electrical undertakings in various parts of the world. La Société pour l'Exploitation des Procédés Thomson-Houston is interested in the new undertaking.

Derby.—The T.C. proposes to apply to the B. of T. for a prov. order for electric light within the districts of Alvaston and Boulton U.D.C.; the parishes of Littleover, Breadsall, Chaddesden, Normanton and Sinfin Moor, in the area of the Shardlow R.D.C.; and Markeaton and Darley Abbey, in the district of Belper R.D.C.

Dover.—The T.C. is negotiating for the supply of electricity to Messrs. Pearson & Co.'s blockyard and to the wireless telegraph station on the Western Heights for the Admiralty.

Mr. Mark Parker, who is applying for prov. orders for the Boroughs of Deal and Sandwich, the Urban District of Walmer and the Rural District of Eastry, proposes, if the scheme is carried out, to apply to the T.C. for a bulk supply of energy, and the Council has decided to carry on negotiations with him, on the satisfactory promotion of a syndicate.

Dudley.—The annual report on the working of the Corporation's electric light undertaking, issued last week, shows that the units sold decreased by 44,571, compared with the previous year. The reduction in output had taken place chiefly on the tramway and motor supply. On the other hand, a healthy increase in the number of units supplied for private lighting had taken place. The year's working resulted in a gross profit of £5,872, a decrease of £105 compared with the previous year. In November last the two-rate system of charging was abandoned and a flat rate system substituted; the alteration is now working well.

East and West Ardsley.—The U.D.C. has informed the Yorkshire Electric Power Co. that it cannot see its way to allow the company to supply current in the district without the payment of an acknowledgment or royalty.

Falkirk.—Despite the much-criticised action of the Corporation in refusing to extend its own electricity undertaking and in allowing a private company to take over certain customers, the past year shows the business to be in a flourishing state. The income was £4,053, and expenditure, £1,965, leaving a balance of £2,088. After paying interest, &c., there was a clear profit on the undertaking of £953.

Finchley.—As a result of the L.G.B. withholding sanction to a loan of £2,200 for electric lighting in the Great North Road and Regent's Park Road, and the decision of the Council to adhere to its original scheme, a deadlock has arisen. Meanwhile the Council has decided to expend out of the current rate £240 for electrically lighting Regent's Park Road.

Fleetwood.—At midnight on Wednesday, last week, the Fleetwood U.D.C. took over the undertaking of the Fleetwood and District Electric Light and Power Syndicate. The closing formalities were conducted in London.

Grimsby.—In connection with the supply of energy by the Corporation to the Great Central Railway Co., the borough engineer reports that the company is proceeding with a power station at Immingham, and that it will supply its works at Grimsby from that station. Consequently it may be expected that in the course of a month or so the company will give the necessary 12 months' notice to terminate its agreement with the Council.

India.—The Kandy Hotels Co., Ltd., of Ceylon, has authorised its directors to borrow Rs. 5,000 for the extension of the electric lighting.—*Commercial Intelligence.*

Longton.—A L.G.B. inquiry was held on September 29th into the application of the T.C. for a loan of £1,740 for the extension of mains through Dresden, where there are 30 applications for a supply. There was no opposition.

Leicester.—At the quarterly meeting of the T.C. on Tuesday, Mr. Jennings stated that the net profit on the Corporation electric lighting undertaking for the past six months, after provision for interest and sinking fund, was £907.

London.—Shoreditch.—It was reported at a meeting of the B.C. recently that the electricity department had made a gross profit during the last year of £21,335. After meeting interest on loans, £10,793, and repaying capital to the extent of £5,951, &c., the net profit on the year's working was £4,117, which was used to wipe off the deficiency brought forward last year.

Bethnal Green.—The Council on September 30th debated for two hours in private, proposals with regard to the supply of electricity in the borough. It was finally decided that the question should stand adjourned until after November 9th, when the new Council will come into office. It is reported that the main business at the private meeting was the discussion of a scheme submitted by Shoreditch. In the result it was decided by 14 votes to 7 not to entertain the proposal.

Hackney.—A C.M.B. auto-converter designed for an input at 460 volts and for an output of 5 kw., 100 volts, is to be obtained at an estimated cost of £57 in connection with an electric standby at the baths.

Marylebone.—The accounts of the electricity undertaking for the June quarter were issued on October 6th, and show steady progress in many directions. The gross income from the sale of current to private consumers was £23,303, as compared with £22,002 for the corresponding period of 1908. Meter rents, public lighting charges, &c., bring the total income for the 1909 quarter up to £25,530—an increase of £1,528 over the corresponding period of last year. The increase was due to large consumers connected during the 12 months. The increase in the number of units sold was greater, the total for the quarter being 1,864,294 units, which is an improvement of 18·8 per cent. over the total for the 1908 quarter. The difference in the above two rates of increase is, of course, due to the lower average price obtained for current, viz.:—3·24d. per unit sold, as against 3·66d. in the corresponding quarter of 1908. This fall in price is balanced by the large additional business of improved load factor and the extended sale of current for power, &c., purposes. The actual total expenditure on revenue account for the quarter is less than in either of the two previous years, the total costs for the 1909 June quarter being 1·29d., as against 1·54d. and 1·78d. in the corresponding periods of the two preceding years. There was a marked lowering of the generating costs (from ·76d. in 1908 to ·63d. in 1909), due in a large measure to advantageous coal purchasing, but still more to the better load factor now obtaining. In conclusion, the report says that, although the results of the first quarter's working give reason to think that the results for the year may exceed the expectations at the time the estimates were framed, this will, however, practically depend upon whether the sales department can obtain a sufficient amount of new business to balance the inevitable further decrease in consumers' accounts due to the more extended use of metal-filament lamps. Up to September 25th, 1,760 of the 1,964 street lamps the Council resolved to light with electricity in place of gas, had been converted, and the results had been quite satisfactory. As a considerable saving in street light expenditure will be effected in the extension of the system, 185 more street gas lamps are to be converted on the same terms, and authority has been given for further lamps to be taken over as the lamps are extended.

Mansfield.—On September 29th a L.G.B. inquiry was held into the application of the T.C. for a loan of £3,560 for electricity purposes, £2,000 being for mains, £500 for meters, £260 for the enlargement of the economiser, and £300 for water-softening plant. There was no opposition.

Merthyr Tydfil.—The B. of G. on Saturday decided to adhere to its decision to light the Workhouse and the Infirmary by electricity, despite the opposition of the L.G.B. It was of opinion that the annual saving for actual lighting under the scheme proposed would amount to at least £100.

Mexico.—The *Electrical World* states that several important hydro-electric schemes are on foot in the mining districts of Mexico. A Canadian syndicate is preparing to erect a large installation on the Conchos River; the Mines of Mexico Co. is about to commence the construction of works on the Mayo River, near Alamos, to supply a rich mining territory within a radius of 175 miles; the Guanajuato Power and Electric Co., and the Michoacan Power Co., are extending their plant, which will have a total capacity of 21,000 H.P. when completed, and the manager reports that besides the mining companies, farming interests and factories are taking power freely, and thousands of irrigation wells are being pumped by electric power. Other new installations will be situated on the Altar River, on the Santiago River, near Guadalajara, on the Quetzalpa River, and on the Matamoros River.

The *Diario Oficial* of August 30th publishes the text of a contract between the Ministry of Fomento and Mr. William A. McLaren, whereby the latter is empowered to utilise the River Realito de Tubares, which runs through the States of Chihuahua and Sinaloa, for hydro-electrical purposes. The concessionaire is granted the right to import, free of duty, once only, all the machinery and apparatus necessary for carrying out the work.—*Board of Trade Journal.*

Runcorn.—The Salt Union, in connection with the development of the Weston Point (Cheshire) trade, has purchased several acres of land from the Manchester Ship Canal Co., and amongst other things proposed is the erection of an electrical installation to provide not only power for its own use, but to supply Runcorn, and, it is stated, Widnes as well. The company's draft order was considered at the meeting of the Highways Committee of the Runcorn U.D.C. on Thursday, last week.

South Africa.—A U.S. Consul reports that a hydro-electric plant on the Crocodile River is projected by the Pretoria Power Co. An output of 20,000 H.P. is contemplated, requiring an expenditure of £700,000; the energy developed will be used for the fixation of nitrogen, the plant for this purpose costing £250,000.

Spalding.—The B. of T. has intimated to the U.D.C. that unless an E.L. scheme is at once proceeded with, the prov. order obtained four years ago will be revoked. The Council has appointed a special Committee to deal with the matter.

Stourbridge.—The Midland Electric Corporation, Ltd., has commenced the supply of electricity to consumers in High Street, Coventry Street, Market Street and New Road.

Taunton.—The inhabitants are watching with interest a passage of arms between the T.C. and the Chamber of Commerce. The latter body questioned the financial soundness of the electricity undertaking, and requested that certain information be made public, in order "to dispel the existing feelings of uneasiness and lack of confidence." The Town Council at its last meeting suggested that the Chamber of Commerce should apply for a L.G.B. inquiry if it were not satisfied, and the Committee has decided to recommend the general body of members to accept the Council's offer.

United States.—Plans have been prepared for the construction of a hydro-electric plant of 30,000 H.P. on the Colorado River in Arizona, to supply an area within a radius of 170 miles of the power station. A large irrigation project is included in the scheme, and the total cost is estimated at more than £400,000.

Woolwich.—The B. of G. proposes to have the electric light installed at the receiving home and dispensary at Plumstead. The borough electrical engineer estimates the cost of the installation with fittings at £45.

Worthing.—The receipts from private consumers during the past half-year have been £464 less than was estimated by the Electricity Committee of the T.C. last March, and this has left the accounts, without any allowance for the depreciation fund, £812 to the bad, a figure which it is estimated will be increased to £830 at the end of next March.

York.—The T.C. has received from the L.G.B. sanction to loans of £550 and £2,510 for the extension of the switchboard and the laying of mains.

TRAMWAY and RAILWAY NOTES.

Bournemouth.—On Tuesday the Corporation discussed proposals for a limited service of Sunday cars. It was pointed out that some £4,000 or £5,000 was lost yearly to the tramways department owing to the cars not running, and that only one other municipal tramway had no Sunday services. However, the proposal was defeated by 31 votes to 10, and a further proposal to take a poll of the ratepayers met a similar fate.

Belfast.—A deputation has requested the Tramways Committee to reconsider the project for removing the central tramway poles in favour of poles on the side walks, on the ground that the "islands" in the centre of the roadways afforded safe places of refuge to pedestrians, and thus prevented many accidents. The Committee promised to give the matter consideration.

Bolton.—A deputation from the Tramways Committee waited upon the Electricity Committee on September 30th, on the subject of the price charged to the tramways department for electrical energy, and the matter was deferred.

Continental Notes.—SWEDEN.—A preliminary contract, says *Affärsvärlden*, has been closed with the Allmänna Svenska Electrical Co., of Västeras, and the Siemens-Schuckert Co., of Berlin, jointly, for the installation of electric power on the border railway, at a cost of 5,120,000 kr. The A.E.G. and Svenska Emissionsbolaget tendered at 5,185,000 kr. The contract stipulates that the State can purchase the plant whenever it pleases, and at the end of 25 years the plant passes to the State without compensation. By the use of electricity it is hoped to render a double track unnecessary, to shorten the time in transit nearly 50 per cent., and to reduce the cost per ton of ore from 52 to 41 öre.

GERMANY.—It is reported that the Berlin electric tramway authorities, who have been using watt-hour meters on their cars for some years to check the consumption of energy, have found by experiment that the most economical mode of driving is also that in which current is used for the shortest aggregate time. They have, therefore, replaced all the watt-hour meters by simple time-meters, consisting of clocks which go only when current is on the motors.

ITALY.—A committee has been formed to work a line of electric tramways from Spezia to Fivizzano. The route will traverse a thickly-populated district, where there is a considerable commercial activity, and a capital of 2,300,000 lire is being raised for the purpose.

The Société Anonyme des Tramways de Bologne has obtained powers to construct and work a new electric tramway from the Alemanni terminus to the suburb of Crociali di Bologna. The new line will be by way of an extension of Via Mazzini tramway.

The Société Anonyme des Tramways de Livourne, of Leghorn, is to construct and work a new electric tramway from the Piazza Cavour-San Jacopo to Via Salviano.

The agreement entered into between the Ministry of Public Works and the Società Ferrovia del Mottarone for the construction and working of an electric railway from Stresa to Mottarone has been approved; also the arrangement entered into between the provincial authorities of Venice and various other communal bodies in regard to the wayleaves requisite for the construction of an electic tramway from Mestre to Mirano.

TURKEY.—The cost of the electrical tramway system for Adrianople is estimated by the municipal engineer at £73,200. It is a condition attached to the work that an Ottoman company shall be formed to control it, but it is anticipated that the order for machinery will be placed abroad.

RUSSIA.—According to the *Financial News* the town of Nikolaieff is desirous of issuing a new loan of 4,000,000 roubles for drainage works, electric tramways, &c.

Darcy Lever.—The Bolton Tramways Committee has decided to extend the tramways to this outlying village.

East and West Ardsley.—The U.D.C. has decided to oppose the proposal of the Wakefield and District Light Railway Co. to abandon the tramway scheme from Wakefield to East Ardsley.

Glasgow.—The proposal for a direct east and west service *via* Parliamentary Road and Sauchiehall Street having been defeated in the T.C., a notice of motion has now been tabled asking that a system of transfer tickets be introduced over this section of the system.

The T.C. Sub-Committee is suggesting the pruning of services on badly-paying routes. The proposal is that the Finnieston Street service be withdrawn, and that the new service along Bilsland Drive be reduced by one-half.

Haslingden.—The T.C. has promoted a conference of representatives of Accrington, Rawtenstall and Haslingden with regard to a through tramway service, in order to obviate the inconvenience caused by the present enforced change at the Haslingden and Rawtenstall boundaries. Accrington and Haslingden agreed to through running between Accrington and Bacup, with an equal number of Accrington and Bacup cars. The Rawtenstall representatives not having power to treat, the conference was adjourned, so that they might consult their Council.

Japan.—The British Vice-Consul at Osaka reports that the City Assembly has voted a sum of £60,000 for restoration work in the area devastated by the fire which occurred in that city

recently. *Inter alia*, it is intended to construct a broad road, three miles in length, and to lay down electric tramlines, which will be linked up with the existing municipal system.—*Board of Trade Journal.*

Kirkcaldy.—It is reported that the promoters of the proposed tramway from Kirkcaldy to the Rosyth Naval Base, *via* Aberdour and Inverkeithing, have temporarily abandoned the scheme.

London.—On Tuesday last the Acton to Willesden section of the Middlesex County Council tramway scheme was opened for traffic. The route links up the London United tramways with the Middlesex Light Railways, giving communication with Cricklewood, Edgware, &c., and is some two miles in length.

The Metropolitan Electric Tramways Co. is stated to be proposing to run a trackless car on the overhead trolley system between Golder's Green tube station and Hendon.

By 33 votes to 7 the Paddington B.C. on Tuesday decided to refuse consent to the construction by the L.C.C. of electric tramways from the Marble Arch *via* Edgware Road to Harrow Road, and from Harrow Road *via* Edgware Road, Maida Vale, High Road, Kilburn, and Shoot-up Hill to Cricklewood. In the latter case a contribution of one-third the cost of necessary street widenings was asked for. It was contended that the tramways were urgently needed by the inhabitants of the localities named, but most of the members of the B.C. apparently favoured a tube railway in preference to tramways, as affording a more desirable means of transit.

Newcastle-on-Tyne.—A meeting of the Tramways Committee of the Corporation was held on September 30th, when it had under consideration the falling off that had been reported in the number of passengers and the consequent diminution of receipts from fares. It was reported that in the course of the preceding week the number of people travelling in the cars was 20,000 less than the number carried in the corresponding week of last year and 40,000 less than were carried in the corresponding week of 1907. The Committee, recognising that this decrease in the number of passengers must have a considerable effect on the income, decided to instruct the tramway manager to take immediate steps for cutting down extra mileage, and for curtailing the expenses of running the service in any way that he thought best. At the conclusion of the business the chairman, Sir Joseph Baxter Ellis, intimated that he would not be prepared to allow himself to be re-nominated for the position of chairman next year.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Western Telegraph Co., says Reuter, will immediately begin the laying of the new cable uniting Argentina directly with Europe *via* Ascension. The cable will cost about £1,000,000, and that it is hoped that it will be in working order by October, 1910. The Chamber has passed the Bill already adopted by the Senate, approving the construction of the cable.

The Atlantic Cable of 1882.—The *Montreal Gazette* states that the cable steamer *Mexican* returned to New York after repairing two of the European cables which were laid by the cable steamer *Faraday* in 1881-2. The breaks were north-east of Sable Island, and the cables were found to be buried several feet in sand. They were in as perfect condition as when laid, although in the water for 27 years. After 12 miles were picked up the cables were again joined through, and the whole of the operations were completed in 36 hours.

Broken Insulators.—Last week four boys were charged at Sheffield with damaging telegraph insulators, and it was stated in evidence that during the last six months 487 insulators had been broken in the Chesterfield district, while 1,115 had been broken in the Sheffield district in 12 months.

Cable Interruptions and Repairs:—

	Interrupted.	Repaired.
Tourane-Amoy	June 17, 1909	
Assab-Perim	July 8, 1909	
Dakar-Conakry	Aug. 20, 1909	
Balikpapan-Kwandang	Sept. 2, 1909	
Cheiksaid-Perim	Sept. 15, 1909	
Hong Kong-Macao	Sept. 25, 1909	October 1, 1909.

Magnetic Storm.—A remarkable magnetic disturbance took place on Saturday, the 25th ult., affecting telegraph systems all over the world by earth currents to such an extent as to interrupt communication in many places for some hours. The disturbance began about mid-day, and lasted, in the case of the lines to Scotland and the north-east of England, for about three hours, but intermittent interruptions occurred up to 9.30 p.m., and in Scotland there was further trouble on Sunday. The phenomena were most noticeable on the longer lines, and affected the submarine cables to some extent. The underground telegraph lines to Birmingham, Manchester, Liverpool and Glasgow, which have metallic returns, were not affected. Auroral displays were observed in northern and southern regions, and there was an exceptionally marked spot on the sun, to which the storm was probably due. It was reported from Kew Observatory that the disturbance was of a highly oscillatory character, and the recording apparatus was unable to register the extreme range, owing to the curve having run across the full width of the paper. On Saturday evening the compass needle moved 70° to the west and then 85° to the east, and the horizontal force showed remarkably large variations. [This note was accidentally omitted from our last issue.]

Telephone Action.—Recently the National Telephone Co. sued Mrs. Philip, of Lexham Gardens, Kensington, for £8 4s. 10s., the balance of an amount due under a guarantee of £10 for call fees. It was shown that the company removed the telephone before the defendant had vacated the premises, though she was living elsewhere, and as she had not had the opportunity of using the telephone for the whole year covered by the agreement, owing to the premature removal of the instrument, judgment was given in her favour.

United States.—The United States Government has issued returns in regard to telegraph and telephone systems in the country, and from particulars published by the *Telegraph Age* it would appear that there are 65 miles of wire in the Republic of Panama, 484 miles in Puerto Rico, 1,403 miles in Alaska and 6,438 miles in the Philippines. These systems handled over 1,000,000 messages. The Weather Bureau controlled 537 miles of wire and 96 miles of submarine cable, and 2,280 places were supplied with forecasts, 734 with special warnings and 5,998 with emergency warnings, all this being done at the expense of the Government. Daily forecasts were sent to 2,141,151 addresses. Puerto Rico boasts of 128 offices and 1,774 miles of wire, and the traffic amounted to 216,489 messages.

Wireless Telegraphy.—On Friday last the Postmaster-General stated that arrangements had been completed with the Marconi Co. for the transfer to the Post Office of all their coast stations for communication with ships, including all plant, machinery, buildings, land, and leases, &c., and for the surrender of the rights which the company enjoyed under their agreement with the Post Office. In addition, the Post Office secures the right of using, free of royalty, the Marconi patents existing and future for a term of 14 years for communication between stations in the United Kingdom and ships, and between stations on the mainland of Great Britain and Ireland on the one hand and outlying islands on the other hand, or between any two outlying islands; and (except for the transmission of public telegrams) between any two stations on the mainland; and on board Post Office cable ships. The inclusive consideration to be paid to the company is £15,000. All the stations will, under the International Radio-Telegraphic Convention, be open for communication equally to all ships, whatever system of wireless telegraphy they may carry; and the Post Office will be free to use or to experiment with any system of wireless telegraphy at its discretion. All inland communication of messages by wireless telegraphy will be entirely under the control of the Post Office. The company will retain the licence for their long-distance stations at Poldhu and Clifden, which are primarily intended for shore-to-shore communication with America. Arrangements have also been made with Lloyd's for the transfer to the Post Office of their wireless stations for communication with ships, and for the surrender of all claims to licences for such communication. In return Lloyd's will receive the plant value of their stations, and will have transmitted to them (with due regard to the secrecy of private telegrams) information received at the Post Office stations in regard to the position and movements of ships, and other maritime intelligence. Lloyd's and the Marconi Co. have mutually arranged to cancel an agreement between themselves which was made in 1901, and which has proved a source of dispute. The Postmaster-General thinks it important that no private monopoly in wireless telegraphy should be allowed to grow up, and hopes that the new arrangements will result in the rapid extension of the use of the system. The negotiations have been conducted in consultation with the Admiralty, who consider it important that the coast wireless stations should be in the hands of the Post Office. The whole of the present employés of good character will be taken over by the Post Office.

The Indian Government, says Reuter, recently issued an order making the importation of wireless telegraph apparatus contraband. It is understood that the Government is considering a scheme to provide important centres with a wireless system worked entirely under European control.

A dispatch from St. Petersburg announces that the Russian Ministry of War is now beginning to establish a network of wireless stations for the purpose of connecting European Russia with the Far East. It is proposed for this purpose to erect a number of intermediate stations between the Baltic and the Pacific Ocean, and it is calculated that from three to four stations would be sufficient to permit of messages being transmitted from the Far East to St. Petersburg. The scheme is supported by the results obtained from the most recent trials which have been made in military telegraphy in Russia, it having been found possible to exchange telegrams between wireless stations on the Baltic and the Black Sea, a distance of 1,240 miles. It was noticed during the trials that the results were extremely favourable in damp weather, and particularly in the night time.

The Government of Uruguay is about to establish wireless stations at Flores Island, Punta del Este and at Cape Santa Maria.

Wireless Telephony.—The Japanese Navy is experimenting with Prof. Missuno's wireless telephone system.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—100,000 porcelain insulators for the P.M.G. See "Official Notices" September 10th.

Victoria.—Accumulators for the P.M.G. See "Official Notices" October 1st.

Telegraph and telephone material for the P.M.G., Melbourne. See "Official Notices" September 10th.

Common-battery switchboard for the North Sydney Telephone Exchange. See "Official Notices" September 10th.

Melbourne.—50 coin attachments, suitable for coins of different value, for the P.M.G. See our "Official Notices" September 24th.

Bray.—October 19th. 50 B.H.P. Diesel oil engine, and high and low-tension disconnecting boxes, &c., for the U.D.C. See "Official Notices" to-day.

Brumby and Frodingham.—October 16th. Public lighting by electricity for the U.D.C., with 55 50-c.p. lamps, poles, wiring, switches, &c.; direct-current, 220 volts, available. Mr. J. Green, surveyor to the Council, Frodingham, Scunthorpe, Lincs. Returnable deposit, 10s. 6d.

Dartford.—October 13th. Wiring the Council Chamber and offices for the U.D.C. Electrical Engineer, Electricity Works, Dartford.

Durban.—In connection with the new Town Hall now in course of erection at Durban, it was recently decided to install 15 electric time clocks, so as to keep uniform time in the various offices. Tenders are about to be called for another turbine set for the electric power station, of a similar capacity to the one lately installed. Tenders are also to be called for a negative booster and cable in connection with the electric tramways.

Great Western Railway.—October 18th. Stores including electrical wires and telegraph apparatus, carbons, &c. See "Official Notices" to-day.

Handsworth.—October 13th. Low-tension feeder and distributor cables (lead-covered and paper-insulated), for the U.D.C. Generating station, Soho Road, Handsworth.

Keighley.—October 16th. Two boiler feed pumps, high-tension switchboard and transformers, 300-kw. motor-generator, and mains for the Electricity Department. See "Official Notices" October 1st.

Leyton.—October 26th. Installation of electric light and hot water heating apparatus at the Canterbury Road Schools, now erecting, for the U.D.C. See "Official Notices" to-day.

Manchester.—October 12th. Wiring and complete electric lighting installation at the Cheetham Baths and Public Hall for the Baths and Washhouses Committee of the Council; specifications from the City Architect, Town Hall (deposit one guinea).

October 19th.—Steel tie-bars for tramway rails, and bolts and nuts for fishplates for the Tramways Committee. Specifications from J. M. McElroy, Tramway Manager.

Mountain Ash.—October 25th. Electrical stores for the U.D.C. electricity undertaking. See "Official Notices" to-day.

Rotherham.—October 23rd. The T.C. has two steam dynamos, 32 kw. each, for disposal. See "Official Notices" September 24th.

South Africa.—According to the *British and South African Export Gazette*, three generators of 2,000-kw. capacity are about to be ordered for the new Farrar-Anglo-French power station; orders will shortly be placed for a number of electric motors for the Rand Water Board; valuable orders may be anticipated in the near future for telephone and telegraph material in connection with extensions of the Transvaal Government services; and the Monomotapa Concessions, Ltd., will be in the market in the near future for a large hydro-electrical plant.

Spain.—November 2nd. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the working of a telephone system in the town of Oviedo during a period of 15 years.

October 15th.—60 years' electric tramway concession from the Calle Mayor del Gras to the end of the West Quay, Valencia. Deposit 2,425 pesetas (£88). Tenders to the Director-General de Obras Publicas Ministerio de Fomento, Madrid. A Spanish company also has preferential rights in this competition.

November 20th.—60 years' concession for constructing and working an electric tramway from Sans to Coll-Blanch (Barcelona). Deposit 1,295 pesetas (£47). Local representation necessary. Tenders to Dirección General de Obras Publicas, Madrid. The Compañia General Tranvias, which has submitted an application, has certain preferential rights.

Turkey.—November 30th. The municipal authorities of Brousa are inviting tenders for the concession for the establishment of a central electric lighting station and a system of electric tramways in the town.

Wallasey.—October 19th. Three miles of electric tramways (overhead line material, poles, wire, ears, &c.) for the U.D.C.; also paper-insulated cables for same. See two "Official Notices" to-day.

Winchester.—October 11th. Electric light installation at the new County Offices, for the Hants C.C. Personal application necessary to Mr. W. J. Taylor, county surveyor, The Castle, Winchester, between 9 a.m. and 5 p.m., and on Saturday between 9 a.m. and 1 p.m.; returnable deposit, £2 2s.

Worthing.—October 11th. Cables for the Corporation. See "Official Notices" October 1st.

CLOSED.

Belgium.—Nine concerns submitted tenders for the establishment of the overhead equipment and the laying of the return rail in connection with the Anderlues-Lobbes section of the Carnieres-Thuin electric railway which is being constructed by the Société Nationale des Chemins Fer Vicinaux, the lowest being that of Messrs. A. Massart & Co., of Houdeng-Goegnies.

Blackpool.—The contract for the E.L. installation at the Lancashire and Yorkshire Railway Co.'s Servants' Home at Blackpool has been placed with Mr. Geo. Morrison, Blackpool.

Bolton.—The Electricity Committee has just placed an order for 25,000 tons of coal, to be delivered during the next 12 months.

Brighton.—The B. of G. has accepted the tender of Messrs. C. G. Reed & Sons, Brighton, for electrical fittings for the Workhouse.

The Lighting Committee of the T.C. has recommended the acceptance of the tender of Siemens Bros. & Co., Ltd., for cable, needed to supply power to the Railway Co., at £2,380.

Bristol.—The T.C. has accepted the following tenders:—

General Electric Co., Ltd.—Carbons for a year, £367.
Electrical Co., Ltd.—Alternating current meters for a year, £762.
Siemens Bros. Dynamo Works, Ltd.—Arc lamp globes for a year, £31.

Derby.—The T.C. has accepted the tender of Messrs. Taylor, Whiting & Taylor, Derby, for the installation of the E.L. at the new schools in Kedleston Road, at £235.

Grimsby.—The T.C. has accepted the tender of Messrs. Cragg & Nephew, Doncaster, for 12 months' supply of steam coal from the Bentley Colliery for the electricity undertaking, at 5s. 11d. per ton delivered at the works. It has further accepted the tender of Johnson & Phillips, Ltd., for two years' supply of cables, at £757.

Halifax.—The B. of G. has accepted the tender of Messrs. J. Sunderland & Co., Halifax, for electrical fittings for six months.

Hull.—The T.C. has accepted the tender of Messrs. Thursfield & Co., of Birmingham, for E.L. fittings for the Town Hall, at £891. The local tender amounted to £1,425.

Kingston-on-Thames.—The T.C. has accepted the tender of Henley's Telegraph Works Co., Ltd., for 880 yards of 1 square inch low-tension cable, at £191; and that of Messrs. W. T. Glover and Co., Ltd., for 880 yards of 10-ampere cable, at £72.

London.—Messrs. Meldrum Bros., Ltd., of Timperley, have secured the order to equip the boilers of the South-Western Hospital of the Metropolitan Asylums Board with their Koker stokers. This is the ninth institute under the Board to adopt this system.

Fulham.—The B.C. has accepted the tender of the Electrical Co., Ltd., for 150 meters in various sizes for a total of £202. This was the lowest tender received.

The following tenders have been accepted for the supply of smokeless steam coal for the electricity works:—

Gilman & Co.—2,000 tons Mapperley Smithan nutty slack, 10s. 5d. per ton.
Kaye, Son & Co.—1,000 tons Cowdenbeath washed peas, 10s. 1d. per ton.
Phillips & Co., Ltd.—500 tons (with an option to take a further 500 tons), Riddings slack, 11s. 3d. per ton.

Hackney.—For the purpose of an electric lighting standby at the Baths, the B.C. has ordered a C.M.B. auto-converter, designed for an input at 480 volts of an output of 5 kw., 100 volts, at £57.

Marylebone.—The B.C. has accepted the tender of C. A. Parsons and Co., at £162 10s. for, putting carbon brushes on three turbo-generators. Orders have been placed with Blackmore & Co., for 5,000 tons of coal, at 10s. 6½d. per ton, and with Cory & Co., for 15,000 tons, at 10s. 7½d. per ton. As a check to coal consumption two additional flue gas recorders are to be obtained from the Auto-Recorder Co., at £60, less 5 per cent.

St. Pancras.—The B.C. has received the following tenders for the re-winding of the 500-kw. armature at the Regent's Park station:—

White, Jacoby & Co., Ltd.	(accepted)	£130
Siemens Bros. Dynamo Works Ltd.		£214
Westminster Engineering Co., Ltd.		£214

Luton.—The B.G. has accepted the tender of Mr. P. T. King, Luton, for installing the E.L. at the Workhouse, at £57 10s. The only other tender was that of Messrs. Shoolbred & Co., at £63.

Mansfield.—The T.C. has accepted the tender of the Western Electric Co., for 500 yards of cable.

Salford.—The T.C. has accepted the tender of the Tudor Accumulator Co., Ltd., for the maintenance of the battery supplied by them (in accordance with their tender accepted in July last) for a period of 10 years, with the option of extension, at £530 per annum.

Truro.—The B.G. has accepted the tender of the National Telephone Co., for overhauling the telephone route to the Workhouse and supplying three new instruments, at £55.

Warrington.—The B.G. has accepted the tender of the Economic Electrical Co., of Liverpool, for electrical requisites, for six months.

Wolverhampton.—The District Electric Co., Ltd., of Wolverhampton and Birmingham, have received instructions to carry out the installation of electric lighting and bells at the new Municipal Baths, now in course of erection.

Woolwich.—The B.C. received the following tenders for 580 yards of 4-core ·05 cable:—

W. T. Henley's Telegraph Works Co., Ltd. ..	(accepted)	£153
Siemens Bros., Ltd.		154
Callender's Cable Co., Ltd.		178

For 310 yards of ·2 and 250 yards of ·05 cable the following tenders were received:—

Siemens Bros., Ltd.	£192	Alternative (accepted)	£47
W. T. Henley's Telegraph Works Co., Ltd. ..	194	,, ...	47
Callender's Cable Co., Ltd.	196	,, ...	48

With reference to the construction of the cooling pond at Plumstead works, the tender of Messrs. M. Stodart & Co., for the supply and laying of 1,248 yards super. of asphalt and 429 ft. of fillet, at 2d. per foot, was accepted.

York.—The T.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for the extension of the electricity mains along the tramways route, at £2,031. The T.C. has also accepted the tender of Messrs. Cox-Walkers, Ltd., Darlington, for a traction switchboard, at £383.

FORTHCOMING EVENTS.

North of England Institute of Mining and Mechanical Engineers.—Saturday, October 9th.—At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. Paper on "Electricity in Coal Mines," by Mr. R. Nelson.

Institution of Mechanical Engineers (Graduates' Association).—Monday, October 11th. At 8 p.m. Paper on "Invention and Industrial Progress, with a Treatise on the British Patent System," by Mr. J. E. S. Lockwood.

Association of Engineers-in-Charge.—At St. Bride's Institute, E.C. Wednesday, October 13th. Presidential address by Prof. Henry Adams on "Standardisation."

Junior Institution of Engineers.—Friday, October 15th. At 7 p.m. Visit to the Model Engineer Exhibition, Horticultural Hall, Westminster.

Institution of Mechanical Engineers.—Friday, October 15th. At 8 p.m. At the Institution House, Storey's Gate. Paper on "Heat Transmission," by Prof. W. E. Dalby.

Electric Organ Blowing Equipments.—The Adnil Electric Co., Ltd. (Marples, Leach & Co., Ltd.), who specialise in electric blowing installations for church and public hall organs, are engaged upon a number of orders of this class. The following may be named:—

St. Anthony's Catholic Church, Forest Gate	A.C.
Brunswick United Methodist Church, Burnley ...	D.C.
St. Chad's Church, Stafford	D.C.
Parish Church, Colne, Lancs.	D.C.
St. Edmund's Church, Roundhay, Leeds	A.C.
St. George's Schools, Ascot	D.C.
St. Mark's, Surbiton	D.C.
The Chapel, Welbeck Abbey (for the Duke of Portland)	D.C.
Earl of Cadogan's Church, Culford	D.C.
The residence of R. W. Hawkey, Esq., Chiswick ...	D.C.
Christ Church, Chester	D.C.
Tonbridge Schools, Tonbridge, Kent	D.C.
Chamber organ at Messrs. Chappell's warehouse, New Bond Street	D.C.
St. Matthew's Church, Southsea	A.C.

In the majority of these cases local contractors have done or are doing the wiring installations. The Marples patent system of regulation is employed in all the D.C. installations, and the "Adnil" single-phase, self-starting A.C. motor in the A.C. installations.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued for the week ending October 16th 1909:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, October 11th.—"A" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

Tuesday, October 12th.—"B" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

Wednesday, October 13th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, October 14th.—"C" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

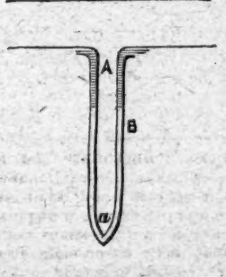
Friday, October 15th.—"D" Company. Practice for the Hopkinson Cup, 7 to 9.30 p.m.

(Signed) P. H. Campbell,
Capt R.E. and Adjutant,
For O.C. E.E., L.D.

NOTES.

London District Engineering Dispute.—The *Daily Telegraph* says that the differences between the employers and workmen in the engineering trades in the London district have now been settled on a satisfactory basis. Recently the employers sought to secure a reduction of wages by 2s. per week. "A protest was at once made, and the employers withdrew their proposal, but substituted another, as the result of which it would be agreed that no change in the rate of wages should take place for five years to come. Strong opposition to the proposal was manifested by some of the older Trade Unionists, but those at present leading the movement saw the tendency of the day was towards a fixed rate of wages for a period of years. They consequently recommended the acceptance of the proposal. The engineers' ballot has now been completed, and though the figures have not been definitely announced, sufficient is known to make it clear that the great majority of the workmen are in favour of accepting the proposed arrangement."

Regenerating X-Ray Tubes.—In *Archives of the Röntgen Ray* for October, Dr. T. G. Beckett, of Melbourne, describes a method of regenerating X-ray tubes which he has used successfully for more than three years. It consists in providing a small glass tube A joined to the focus tube, and having a slightly porous tip at *a*; an outer tube B is filled with mercury to seal the tip of A, and is pressed on over a velvet sleeve at the base of A, which holds it tightly in position, though a rubber band or other additional safeguard to hold B securely is advisable. When the tube grows hard, B is lowered until the tip *a* is exposed to the air; after a sufficient time, depending upon the hardness of the tube and the porosity of the tip, B is replaced, and the X-ray tube can then be used in any



position, without fear of spilling the mercury. Dr. Beckett has had a tube thus regulated in constant use for over two years, and would not exchange it for a new one. The tip of A is most easily made porous by heating it to redness, and directly the redness has disappeared, lightly touching a pool of clean mercury with the tip, when a multitude of fine fissures will instantly be formed. This is a delicate operation, as, if the glass is too hot, the fissures will be superficial only, and if it is too cold, none will be formed. If held too long in the mercury, the glass cracks too much. The best results are obtained when it takes 30 seconds to reduce the vacuum to the proper value; too rapid an action is fatal.

National Institution of Apprenticeship.—The Report for 1908 shows that 166 boys and 16 girls were apprenticed during the year, and the total since May, 1905, now amounts to 610. Many others have been placed to learn good trades, but without indentures. The analysis shows that some 16 were apprenticed to electrical trades during the year, making a total of 40 boys and three girls since 1905 under this heading. The premiums paid in 1908 amounted to £2,263, but the bulk of these are repayable by parents or guardians in instalments, and £981 was so repaid during the year. Some 3,000 applications for assistance are now received yearly, and a sum of £13,000 is required to deal with these; the Council therefore appeals urgently for funds to carry on the work, which should be sent to Messrs. Robarts, Lubbock & Co., 15, Lombard Street, E.C.

Electricity in Battleships' Turrets.—The trial of an electrical system of working the primary guns in the turrets of our battleships and cruisers of the *Dreadnought* type has not (says the *Naval and Military Record*, Plymouth) given entire satisfaction, but it is hoped that as experience is gained many of the difficulties will be overcome. In comparing the hydraulic system with electrical power there are advantages and disadvantages on either side, and, naval men being conservative to a degree, are in no hurry to part with an old for an untried system. Gunnery men, however, have come to recognise that to serve turret guns rapidly with ammunition is one of the principal needs of the Navy, since rapidity of fire is now so important, and cannot be obtained without a thoroughly reliable and efficient service of projectiles and gun charges from shellroom and magazines to the breech of the gun. The rapidity of movement in the electrical apparatus for the ammunition service has been found by the Americans to excel that of hydraulic power, and most of their heavy ships have consequently been fitted with electricity. The same conclusion is now being arrived at by the experts of our own Navy, but as yet the electrical service is not so reliable as hydraulic power in British ships. Considerable improvements, however, are taking place, and at least one large shipbuilding firm has given the turrets an installation of electrical apparatus that gunnery officers find to their liking. Rapidity of fire is so important from primary guns that it is considered expedient to persevere with electrical plant.

The European Electro-Metallurgical Industry.—The severe competition which started recently as a consequence of the failure of the negotiations for the establishment of a price convention in the carbide of calcium industry is stated by the *Frankfurter Zeitung* to be making itself still perceptible in an undiminished degree in the markets of Continental Europe. In the second week in September the price of unpacked products at Continental works was 6s. per cwt., as compared with the former quotation of from 7s. 6d. to 8s. 6d., but since then the price has receded to 5½ fr., or, say, 4s. 5d. per cwt. It is obvious, the newspaper remarks, that such underselling is ruinous to the whole industry, and the result has always manifested itself in the sense that various small producers of carbide of calcium have either collapsed or suspended production. It is considered that an improvement in the whole situation of the market can only be brought about by co-operation in the form of an international syndicate, especially as foreign competition is becoming keener.

The same observation, it is continued, also applies to ferro-silicon. This product of 50 per cent. ranges at present from 9s. to 9s. 6d. per cwt. packed at maker's works, with a scale of 6d. per cent. and double hundredweight. How large the reduction has been is illustrated by the circumstance that the price in 1907 was on the level of from 19s. to 20s. per cwt., and in February of the present year it stood at 11s. 9d. to 12s. 3d. The price of aluminium, even when a present rate of 1s. 5½d. per kilogramme is assumed to be the normal, is substantially less than the cost of production. The position of ferro-chromium is the same. The common cause of the unfavourable development which the electro-metallurgical industry has experienced is unchecked expansion, which has led to the premature progress of the producing works and to heavy overproduction. It is therefore expected that a thorough recovery will only be possible when success attends efforts to bring the output and consumption into better proportion to each other.

Football Notes.—Electrical Football League.—Last Saturday the County of London Electric visited the St. James' Electric, when the latter proved victorious by 10 goals to 2. Next Saturday the Metropolitan Electric visit the County of London Electric at their new ground in Buckholt Road, Wandsworth, near Wandsworth Town station (L. and S.W. Railway).

The "South Metro." Electric.—The South Metropolitan Electric Light and Power Co., Ltd. (Greenwich), have formed a football club to be known as the "South Metro. Electric," and Mr. C. H. Ellis, the hon. secretary, writing from 37, Annandale Road, East Greenwich, S.E., informs us that the club is about 20 weak, and have so far been unsuccessful in obtaining a ground. They would, therefore, be glad to hear of anything in this way from our readers, and would be very pleased for the opportunity to play a "friendly" with clubs in the same line who have a ground.

Train Lighting.—Comparing three systems of lighting railway trains with electricity—with a steam-driven dynamo and batteries, with storage batteries charged at the termini, and with axle-driven dynamos and batteries—Mr. O. W. Ott recently stated at Chicago that the costs worked out as follows:—

	Steam dynamo.	Storage.	Axle dynamo.
Total cost per car, per year; operation	$533.18	$599.61	$631.33
First cost per car; equipment... ...	874.24	1,073 50	1,673.50
Weight of equipment per car; lb. ...	2,075	3,800	4,900

The actual cost of maintaining electric light on more than 150 cars on a prominent railroad in the United States during the year 1908 was found to average $524 per car, and the average cost of equipment was $1,344 each.

An Australian Claim.—According to the *British Australasian* the action in which Francis Edward Bradford, electrical engineer, claimed from the Victorian Government £3,500 for alleged breach of contract in connection with the proposed electrification of the suburban railways, has been concluded. The jury failed to agree.

Inquiries.—A correspondent wishes to obtain a "turn-down" lamp with two filaments, operated by tilting the lamp, when a globule of mercury, acting as a switch, connects the filament desired.

Makers of the "Flare" arc lamp are asked for.

Mr. C. Mittelhausen, electrical engineer and manager to the Bexley U.D.C., will be glad if any reader who has supplied energy to blocks of cottages at a fixed price per lamp per quarter, will let him know the financial results of the system, as ascertained by a master meter covering the whole block.

Will.—It is announced that the late Mr. Hugh Erat Harrison, Principal of Faraday House, left estate of £17,012 gross, and £16,740 net personalty.

Concert.—The Anchor Cable Athletic Club held a tea and smoking concert last Friday week, at Leigh. During the evening, Mr. A. Crooke, chairman of the Leigh and District Cricket League, presented the Second Division Championship cup and medals to the members of the cricket team.

National Electrical Manufacturers' Association.—The next committee meeting of this Association will be held on Tuesday, October 12th, at Balfour House, Finsbury Pavement, E.C., at 2.30 p.m.

Electrical Production of Steel.—The Siemens and Halske Co., of Berlin, announces that the working up of minette iron ore in Lorraine-Luxemburg by means of the electrolytic process, has yielded an unusually favourable result. The electric steel plant erected at the Eicher Hutten Verein, of Le Gallais Metz & Co., at Dommeldingen, Luxemburg, according to the patents of the Gesellschaft fur Elektrostahlanlagen, has produced, since it was first set in operation, steel which is said to be in every respect equal to Swedish steel. It is considered that the manufacture of electric steel in this way on the Rochling-Rodenhausen system should give an unexpected importance to the whole of the Lorraine-Luxemburg iron ore industry, as the district contains very considerable quantities of ore, and the opportunity for transport leaves little to be desired.

Corrosion of Iron.—At the Iron and Steel Institute's autumn meeting, Mr. J. N. Friend read a short paper on this subject, in which he again upheld the theory that the presence of acid is essential to the corrosion of iron; almost any acid is effective, but the wide prevalence of carbonic acid has rendered this the most common agency, and thus has arisen the erroneous impression that carbonic acid is necessary to the formation of rust. The author points out the great difficulty of definitively deciding between the acid and the electrolytic theory, and criticises experiments which have been alleged to disprove the former, claiming that the balance of evidence is decidedly in its favour. He concludes that pure water is not sufficiently active to effect the corrosion of pure iron in the presence of oxygen alone at ordinary temperatures, while Dr. Walker (see Elec. Rev., August 20th, 1909) holds the contrary view.

Institution and Lecture Notes.—Prof. H. Stroud delivered a lecture at Armstrong College, Newcastle-on-Tyne, on the 2nd inst. on "Wireless Telegraphy," with the aid of numerous experiments and lantern slides. The antenna at Armstrong College is fan-shaped. Between the two high towers is stretched a double cable of stranded wire, insulated at each end by porcelain insulators of special construction; eight wires in two sets, so as to avoid the gable of the King's Hall, are connected with the double cable, and pass down to the experimental room in the physical department, all the wires being joined together at the lower end and insulated from the earth. In the experimental room the antenna can, by means of a switch, be put in connection with the spark sender, the Poulsen arc sender, the receiving circuits, or the earth. During the lecture the antenna was used in connection with a spark sender and a receiving circuit on the table in the Hall, and signals were sent to and received from Cullercoats wireless station. The electrolytic detector was used, but instead of the telephone ordinarily employed for receiving the signals, a galvanometer was used, so that all could see the movement of the spot of light which indicated that electric waves were being received from the Cullercoats station eight miles distant. The lecturer expressed his thanks to Mr. Morris-Airey, who had assisted in the design and equipment of the College wireless station, and to Mr. Sörensen, engineer and manager of the Cullercoats station.

Association of Engineers-in-Charge.—The programme of the new session gives evidence of successful activity on the part of the Council. Papers on steam turbines, the heating and ventilating of public buildings, arc lamps, recording instruments, and electric welding are included, besides several of the social functions which form so notable and useful a feature of this society's organisation. On Wednesday next week the new President, Mr. Henry Adams, M.Inst.C.E., will deliver his inaugural address on "Standardisation," with Mr. James Swinburne, F.R.S., the retiring president, occupying the chair. Communications should be addressed to the Hon. Sec., Mr. Hy. Capsey, 112, Melbourne Grove, S.E.

The roll of the Institution of Municipal Engineers now stands at 612 members and 82 students, making a total of 694—a remarkable number, considering the short period during which it has been in existence.

Institution of Mining Electrical Engineers. — At the meeting last week, the President stated that articles of association had been drawn up, the principal clauses of which he explained. A London branch was being formed, with Mr. R. Krall, Balfour House, Finsbury Pavement, E.C., as secretary. A committee had been appointed to inquire into the causes of electrical accidents in mines, and to report in December. Further reference will be made to this meeting next week, the report having come to hand as we go to press.

New Turbine Gearing. — It is reported in the daily Press that Rear-Admiral Melville, his partner Mr. Macalpine, and Mr. George Westinghouse have jointly evolved a system of spur gearing which enables a high-speed turbine to drive a low-speed propeller without noise and with an efficiency of 98½ per cent. The pinion driven by the turbine, it is stated, is mounted on an elastic steel floating frame, which enables it to adjust itself instantly to changes of alignment. Immense advantages are claimed for the system in connection with marine propulsion. A detailed description of the device appeared in *Engineering* of September 17th last.

Appointments Vacant. — The Municipality of Bloemfontein has been advertising for a station engineer at its electric power station at a commencing salary of £27 10s. per month, rising to £30 per month.

The Municipality of Kroonstad has been advertising for an electrical engineer for its electric power station at a commencing salary of £30 per month, rising to £35 per month.

Sub-station electrician for the Mountain Ash U.D.C. (£2). See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. E. Hesketh, resident engineer and manager of Cromer electricity works, has been appointed resident engineer and manager of the Alderley and Wilmslow Electric Supply, Ltd.

The City Council of Bristol last week appointed Mr. A. Wilson, who had been in its service for four years, the last two E. distribution superintendent, as deputy city electrical engineer at £300 per annum, leaving over the question of future increments until a committee now sitting on the general increment question had reported.

The Electricity Committee of Brighouse Corporation have appointed Mr. Amos Aspinall, who has long been in its service, manager of electricity department.

General.—Mr. A. Whalley, M.I.E.E., is retiring from the British Insulated & Helsby Cables, Ltd., to commence a consulting practice, from November 1st, at 27, Chancery Lane, London, E.C. (care of Knox, Hassal, Dodd & Co.) and at 19, Croxteth Grove, Liverpool. During 23 years with the Telegraph Manufacturing Co., Helsby, and with the British Insulated and Helsby Cables, Ltd., he has been chief engineer at Helsby and manager and engineer at Liverpool respectively, and has been responsible for the design and manufacture of every description of insulated wire and cable for lighting, power, traction, telephony, &c., also of all apparatus for complete trunk and local telephone exchanges, telephone instruments, &c., and, in addition, of telegraph equipments for railway and postal administrations. He has had charge of important cable contracts abroad, and carried out the equipment of the London and other large telephone trunk exchanges for the Post Office during the last six years, besides common battery exchanges. For 20 years switchboards, &c., have been supplied under his control to the National Telephone Co. His connection with telephony dates from 1881, in the days of the Lancashire Telephone Exchange.

After six years with the General Electric Co., Ltd, Mr. Oswald L. Record has left to take charge of the accessories department of the Lahmeyer Electrical Co., 109-111, New Oxford Street.

The *Canadian Gazette* states that Mr. W. W. Pope, K.C., for 20 years connected with the solicitor's office of the Grand Trunk Railway, has been appointed secretary to the Hydro-Electric Power Commission. The chairman is the Hon. Adam Beck.

It is stated that Mr. Wm. Griffith, chief inspector of the electrical and signal department of the L. & N.W. Railway in the Manchester Division, stationed at Tyldesley, is about to retire. Mr. Griffith has spent 40 years in the company's service.

Mr. F. H. Banbury, engineer of the Acheson Oildag Co., of Niagara Falls, sailed for Europe towards the end of September. Mr. Banbury is an Englishman who went to America about five years ago, and was connected with the Commonwealth Edison Co., of Chicago. A little over a year ago he became connected with the Oildag Co., and he has now come to Europe in the extended patent interests of that company.

Tramway Officials.—The York Tramways Committee has recommended the appointment of Mr. J. W. Hamm, city electrical engineer, as general manager of the tramways, the remuneration, therefore, to be fixed at a later date.

Obituary.—We regret to learn that on Wednesday morning last Mr. Charles J. Robertson, M.I.E.E., engineer and technical director of the Robertson Electric Lamps, Ltd., Brook Green, died after a prolonged illness.

NEW COMPANIES REGISTERED.

Halesowen Lighting and Traction Co., Ltd. (105,136).—This company was registered on September 29th, with a capital of £10,000 in £1 shares, to acquire the rights, powers and privileges granted to G. Balfour by the Provisional Order granted by the Board of Trade under the Electric Lighting Acts, 1882 and 1888, in respect of the Rural District of Halesowen, Worcs., as amended and confirmed by the Electric Lighting Orders Confirmation (No. 1) Act, 1908, and to carry on the business of electricians, suppliers of electricity for light, heat and power, &c. The subscribers (with one share each) are:—G. Balfour, M.I.E.E., A.M.I.M.E., The Elms, Bromley, Kent; H. L. Williams, Briarwood, Worcester Park, engineer; P. M. Moon, 123, Mount View Road, Stroud Green, N., engineer; W. Shearer, Swinton, King's Avenue, Bromley, Kent, secretary; W. J. Selley, 168, St. Albans Road, Seven Kings, clerk; H. W. Gill, 29, Shrewsbury Road, Forest Gate, clerk; A. H. Beatty, 30, Kensington Mansions, Earl's Court, S.W., contractor. Minimum cash subscription 10 per cent. of the shares offered to the public. The number of directors is not to be less than three or more than five; the first are G. Balfour, W. Shearer and A. H. Beatty; qualification, one share; remuneration as fixed by the company. Registered by Pemberton, Cope, Gray & Co., 5, New Court, Lincoln's Inn, W.C.

Electrolytic Apparatus Syndicate, Ltd. (105,153).—This company was registered on September 28th, with a capital of £5,000 in £1 shares, to adopt an agreement with J. T. Niblett for the acquisition of inventions for electrolytic apparatus, and to carry on the business of manufacturers of and dealers in all kinds of mechanical, chemical, electrical and electrolytic apparatus (except for electro-plating). The subscribers (with one share each) are:—J. T. Niblett, Cleve Hall, Denmark Hill, S.E., electrical engineer; P. J. Manger, 29, Girton Road, Sydenham, S.E., accountant; G. H. Humphrey, Cloyne, Hutton, Essex. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, £20; remuneration, £25 each per annum (chairman, £50). Registered office, 11, Victoria Street, S.W.

Therol Foreign Patents Syndicate, Ltd. (105,185).—This company was registered on September 29th, with a capital of £2,500 in £1 shares, to acquire and turn to account a certain patent, to adopt an agreement with G. G. Bell and J. St. V. Platts, and to carry on the business of electricians, mechanical engineers, manufacturers and workers of, and dealers in, electricity, &c. The subscribers are:—J. E. Spagnoletti, Bowden Green, Pangbourne, Berks., engineer, 250 shares; H. M. Bailey, 20, Addison Road, Chiswick, W., electrical engineer, 100 shares. Private company. The number of directors is not to be more than six; the first are Sir James Clark, J. E. Spagnoletti and H. M. Bayley; qualification, £100; remuneration as fixed by the company. Registered office, Goldhawk Works, Goldhawk Road, W.

Westminster Tool and Electric Co., Ltd. (105,206).—This company registered on September 30th, with a capital of £1,000 in 500 "A" shares of £1 each and 10,000 "B" shares of 1s. each, to carry on the business of electrical engineers, electricians, suppliers of electricity for light, heat, motive power or otherwise, manufacturers of and dealers in electrical apparatus, &c. The subscribers (with one share each) are:—S. T. Keagh, 128, Landcroft Road, East Dulwich, S.E., clerk; W. M. Bailey, Kingswyn, Forest Hill, S.E., accountant; H. Parker, Clonkeen, Longlands, Park Road, Sidcup, clerk. Private company. The number of directors is not to be less than two or more than five: the first are F. D. Johnson, F. W. White and A. Stewart; qualification, £50; remuneration as fixed by the company. Registered office, Palace Chambers, Bridge Street, Westminster.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Penrith Electric Supply Co., Ltd. (99,764).—Mortgage on certain land and premises in King Street and Friar Street, Penrith, dated September 1st, 1909, to secure all moneys due or to become due to the Bradford District Bank, Ltd., Bradford.

Electric Supply Co. of Victoria, Ltd. (66,059).—This company's annual return was filed on September 14th, when 147,875 preference and 125,000 ordinary shares had been taken out of a nominal capital of £300,000 in £1 shares (150,000 preference). £1 per share has been called up on 22,382 and £22,382 has been received. £249,993 is considered as paid. Mortgages and charges £167,955.

Davis Electrical Co., Ltd. (99,740).—Issue on September 22nd of £500 debentures, part of series created November 12th, 1908, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £600.

Bray, Markham & Reiss, Ltd. (74,871).—This company's annual return was filed on August 27th, when 8,000 shares had been taken up out of a nominal capital of £20,000 in £1 shares; £8,000 has been paid. Mortgages and charges: Nil.

CITY NOTES.

Willans & Robinson, Ltd.

Mr. J. C. Peache, managing director, presided on Tuesday at the Cannon Street Hotel, over the thirty-first half-yearly meeting of the above company.

The Chairman, in moving the adoption of the report (see Electrical Review, October 1st, page 546), said that the result shown

for the half-year's working was, the directors regretted to say, unsatisfactory. After allowing for the loss on the half-year's working, the balance standing to the credit of the profit and loss account was insufficient to provide for the payment of the full preference dividend, and there was no surplus to go to the payment of interest on, or to the redemption of, the funding certificates. The directors realised it was a result that the shareholders must view with concern and anxiety. In the course of his remarks he hoped to be able to lay some facts before them, which would allay in some degree that anxiety, and to satisfy them that when this period of failing trade was past, they would again attain the condition of progress that had lately marked the course of the company's affairs. The disappointing result of this half-year's working was entirely due to the continued depression in trade. They might take what comfort they could from the fact that they were not alone in this unfortunate position. Other concerns all over the country were suffering in the same way, and their published accounts were in varying degrees telling the same tale. The principal business of this company was the production of machinery for the generation of electricity. This was a line of business that had been adversely affected to a greater extent than, perhaps, any other in this country. This branch of engineering was suffering, in common with other industries, from the present widespread want of confidence and reluctance to risk the employment of further capital; but beyond this there were causes, confined to this industry alone, which had been accentuating in its case the effects of the general depression in trade. The introduction of the metallic-filament lamp and the great economy in current realised by its use was having a very serious effect on the revenue of electric lighting stations. In all parts of the country the output of current was falling off, and electricity concerns, instead of having to order new plant, were finding that their existing plant was in excess of their present requirements. In the end, no doubt, this cheapening of electric light would lead to a great extension of its use and a renewed demand for plant. For the present, however, new construction was at a standstill, and the business of building electric generating plant for this country, at all events, was in a state of stagnation. The number of orders to be obtained in this country for electric generating plant were few, and owing to excessive competition, prices had been driven down to a level that left only a narrow margin for profit. The orders obtained in recent half-years had been insufficient to keep the works fully employed. In the second half of 1908 the value of orders obtained was disappointing, but that half-year profited by a large balance of unexecuted orders brought forward. In the first half of the year 1909 (the half-year they were now considering) the value of orders obtained was considerably larger than in the previous half-year. That was an encouraging feature, but the bulk of their old orders had then been worked off, and for two months in that half-year it was necessary to put the works on short time. Since June, he regretted to say that the improvement experienced in the early part of the year had not been maintained, and there was no doubt that for the present and for the immediate future they had to face a continued scarcity of work. He would briefly give an account of the steps they were taking for obtaining business to keep their shops profitably employed. They had devoted great efforts to obtaining orders for steam turbines abroad, and in this direction they had met with considerable success, and had obtained good orders for Canada, Australia, South Africa and Japan. Indeed, in the absence of work coming forward for this country, the bulk of their orders for electrical generating plant had been from abroad. They had endeavoured with some success to extend their connection with industrial concerns in this country, and had supplied a number of turbine plants for driving the machinery of cotton mills, collieries, harbour works, and so forth, but in these directions work had been restricted by the general depressed state of trade. Cotton mills, for instance, were now running on short time, and no new mills were being built. Under their agreement with the English Diesel Co. they were entitled to a considerable volume of orders for Diesel oil engines. Unfortunately, due to the depressed state of trade, the Diesel Co. had not so far been able to keep them supplied with orders at the rate they were entitled to expect under their agreement with that company. They were still building a certain number of Willans engines, and had several in course of manufacture at the present time. Repair parts for Willans engines still furnished them with a substantial volume of work. Condensing plant, a comparatively new manufacture with them, brought in a certain number of orders. Parts for motor vehicles also gave them profitable employment, but in all these branches they were adversely affected by the present slackness of trade. There were several new branches of manufacture in process of development. Hydraulic turbines and high-lift turbo-pumps formed two of these, and there were a number of both these turbines and pumps on order in their shops. The first of the turbo-pumps had passed its trials with most satisfactory results. In this new departure they had the co-operation of Mr. Orten-Böving, an engineer of wide experience in the manufacture and working of hydraulic turbines and pumps. He had already obtained a number of orders for them, and it was hoped that an increasing business in this class of machinery might be relied on in the future. They were also engaged on the development of some other branches of manufacture. These had not yet reached the final stage, but they trusted in the near future some of them would be of material help to them in earning a profit for the shareholders. Notwithstanding the poor result of the past half-year's working, the position of the company's affairs to-day was a sound one. In cash and marketable securities they had a substantial provision against the needs of the immediate future. The cash balance at June 30th was £49,339; marketable investments held at the disposal of the company, £11,653. The item of debtors stood at £168,703. Of this total £74,000 had since been received, and the balance was a good asset. The result of the agreement made with their debenture stock holders in March now showed in the balance-sheet. By that agreement the fire fund was made available for the redemption of debenture stock. By June 30th last they had actually redeemed £8,767 of stock, making a profit of £1,761 on the transaction, and this profit had been added to the reserve. Up to that day a further sum of £9,666 had been redeemed, making in all £18,433. At December 31st last the reserve fund stood at £36,331. At June 30th it stood at £62,629, this increase was due to the release of the fire fund securities which were ear-marked for the redemption of debenture stock. Since June 30th they had settled a claim arising out of a contract made for the supply of large gas engines. This contract was entered into by the company in the year 1903. For some years past it had been known that the company had incurred a heavy liability on this account: a lawsuit has been pending, and in July last, acting under the advice of counsel, a settlement of all claims was arrived at with the plaintiffs, by the payment to them of £15,000. This loss had to be set against their reserve fund. As stated in the report, with the exception of any loss that might be made on the final disposal of the Queen's Ferry works, the settlement of this lawsuit closed the last of the serious difficulties arising out of the situation dealt with by the Advisory Committee in the spring of the year 1904. For the Queen's Ferry works, there had been one or two encouraging inquiries, and there was some hope that a sale would result from negotiations now in progress. In the meantime the works had been kept in good order and repair. The charge on account of Queen's Ferry for the half-year was £1,170. A considerable part, however, of this sum was due to costs that would not recur—such as salaries to officials whose terms of engagement did not terminate until a recent date. In future the cost of maintaining Queen's Ferry would probably not exceed £600 per half-year. It was necessary to be patient about the disposal of this property. It was hardly likely that a price would be obtained that would fully cover the figure at which the works stood in the balance-sheet. On the other hand, it would be unwise to attempt to force a sale by accepting an inadequate offer. The present depressed condition of trade was much against the prospect of their being able to find a purchaser, but the works formed a very fine industrial property, and they must be content to hold it for the present. The sale of surplus plant at Queen's Ferry realised some £9,313, and with the proceeds they had been purchasing new and efficient tools for the equipment of the Rugby works; £338 10s. had already been spent in this way, and they had a balance of £8,974 available for the purchase of further tools. This £8,974 was included in the item of debtors, £168,703 15s. 7d., and although ear-marked for the purchase of plant, with this qualification, formed an addition to the cash resources of the company beyond that shown on the balance-sheet. A bad time like the present afforded a favourable opportunity for cutting down expenses, and, as they were aware, the directors had devoted their special attention at this point since 1904, though this process could not be carried on indefinitely. Nevertheless, during the past half-year it had been possible to effect further material reductions, and there were still other reductions that were being carried out at the present time. This matter of expenses was one that had had, and would continue to have, their close attention. There was, however, one direction in which they dared not cut their expenses—that was in their machinery for procuring orders. With orders hard to get, their efforts for effecting sales had to be redoubled. The expenditure on travelling, for instance, might appear large, but in bad times like these, expenditure of this sort was even more necessary than in good times, when orders were coming in freely. The cost of patents and development work again showed an increase—£7,974 at June 30th, as against £7,281 at December 31st. Depreciation at the rate of 10 per cent. per annum had, as usual, been written off this half-year from the January total—viz., £358, but the additions during the half-year had more than balanced this. These additions had been principally occasioned by development work on water turbines and high lift pumps. In the opening up of new branches of manufacture, expenditure of this description was inevitable, but it was, they trusted, expenditure which would yield a good return in the future, and as already explained it was of vital importance to the company to widen the field of its operations. The board were not in a position to make any proposals with regard to the vacant post of chairman or as to additional directors. It would be a good thing for the company were it possible to secure as chairman, a man of first-class ability, in touch with the financial and business interests on which they were dependent, and one who would be able to effectively further and extend the business of the company. The board were giving this important matter their careful attention, but until they were in a position to place before the shareholders recommendations which would fully meet the needs of the case, they would ask them to leave the management of the company's affairs in the hands of the three directors who now formed the board. The work of the two ordinary directors had not been confined to the business of the monthly board meetings. They had carefully looked into the affairs of the company, and had been active in forwarding the interests of the company in other ways. He had not hesitated to call for their help in matters of importance as these had arisen, and their meetings had by no means been confined to the regular monthly fixtures. In Mr. Robertson they had a very active and helpful colleague. Both Mr. Anderson and he felt that his accession at a time when the company was passing through a difficult time, though of advantage to them, was rather hard on him. The company has a most capable staff of servants, and the works were in a high state of efficiency. They trusted that the present setback was

but temporary, and that as, and when the state of trade returned to a normal condition, the works were well prepared to take full advantage of it.

Mr. Shirley Price, in seconding the motion, said the chairman had made no attempt to gild the pill. He did not think the pill after all was so difficult to swallow. It was not so serious as many he had had to swallow that year in regard to other concerns. He thought there was a hopeful future before them.

Col. Plunkett asked how much of the item of £5,162 for the salaries of staff was due to Queen's Ferry, and how much to the Rugby works.

A Shareholder asked if anything was likely to be done with the freehold premises at Thames Ditton.

Mr. Bulford said that they heard now that a lawsuit had been settled for £15,000, but they had never heard of that before. However, he wished they would treat the Queen's Ferry works in the same way, for the board had been telling them year after year what they were going to do with Queen's Ferry, and they were about sick of it altogether. He would like to know whether the assets were valued by an outside valuer or by their own. How did they arrive at £300,000 for the Rugby works—it was a sum which would buy about half Rugby. He did not believe in the report a tiny bit, but considered the assets were faked, and judged the board for what they had done. The board had brought them to beggary. He considered that a body of business men should investigate the affairs before the report was adopted.

Mr. W. Steward wished to know whether the reduction of expenses was anything in proportion to the reduction of the volume of business. A year ago Sir Gilbert East made some observations to the effect that Mr. Peache could not do everything, and said his subordinates could force him to pay high salaries. The expenses had apparently increased, but he did not know how that was attributable to Queen's Ferry. Whilst everyone felt confidence in the management of the works by Mr. Peache, yet the shareholders did not feel a corresponding confidence in the department which might be called the business management, and he supported what had been said as to the need of a good man as chairman.

Mr. Lines suggested that if they could not get a good class man as chairman they might amalgamate with a good class concern.

Replying to these and other questions, the Chairman said the freehold premises at Thames Ditton stood at the figure to which they were written down, and they were doing all they could to get rid of them. The lawsuit had been mentioned several times, but naturally it was a thing they did not talk much about for fear of prejudicing the result. The claim made against them was for over £100,000, and the proceedings had been going on for three years. Under the advice of counsel, they settled the whole matter for £15,000. It was a big sum, but not, he thought, an unreasonable settlement. That sum did not include their own costs. He could assure them that they had good reason for hopes as to the disposal of Queen's Ferry, although it was quite true that they had expressed good hopes in the past. The assets had not been valued by an outside valuer, but if there was a strong feeling on the subject it could always be undertaken. The board were perfectly certain that a valuation would more than justify the figures in the balance-sheet. Everyone knew that it was impossible to reduce working expenses in exact ratio to a reduction of business, although they tried to economise all they could. It was a reasonable suggestion to include the directors' fees with the salaries of the staff, for they were paid for actual work in the business. Taking the two together, the figure for the second half of 1908 was £7,652, whereas in the past half-year it was £7,150, which showed a reduction. Neither the finding of the right man as chairman, nor getting offers for an amalgamation with a firm which would be an advantage to the company, were easy things, but the last point had been under their consideration, and a year or so ago there was an actual proposition before them. If, in the future, it were to appear desirable to again consider such a matter, he could assure them that they were very ready to give it their serious consideration.

The report was then carried with one dissentient, and a vote of thanks to the board concluded the proceedings.

Bank Rate.—The Bank Rate was yesterday raised to 3 per cent.

Sao Paulo Tramway, Light and Power Co.—A quarterly dividend at the rate of 10 per cent. per annum is announced.

Eastern Extension, Australasia and China Telegraph Co.—An interim dividend of 2s. 6d. per share, tax free, for the quarter ended June 30th, is announced.

Para Electric Railways and Lighting Co., Ltd.—The directors announce a dividend on the preference shares for the half-year ended May 31st, 1909, at the rate of 6 per cent. per annum, less tax, payable on November 1st.

Glenboig Union Fire-Clay Co., Ltd.—A dividend of 8 per cent. has been declared on the ordinary shares for the past year.

Lisbon Electric Tramways, Ltd.—An interim dividend of 2½ per cent. has been declared.

Puebla Tramway, Light and Power Co.

The directors state that the issue of their report for 1908 was delayed, pending the completion of the arrangements for the acquisition of the local competing lighting company (Compania Hidro-Electrica de San Agustin, S.A.). During the period covered by the accounts the earnings of the tramways have been affected (as foreshadowed in the report to December, 1907) by the paving improvement work which is being carried out by the Municipality of Puebla, and in connection with which considerable betterment work and expenditure has had to be undertaken by the company which, when completed, will, it is anticipated, result in benefit to the tramway business. The lighting business (says the *Financial Times*) has suffered very severely during the last two years in consequence of the fight with the San Agustin Co. The board, however, are glad to state they have succeeded in putting an end to this competition by securing for the company the control of the San Agustin Co. as from July 1st, 1909, on satisfactory terms, and they expect a material increase of revenue. The gross and net earnings of the power business continue to show a steady increase, and the results therefrom are satisfactory. The supply of power to the San Rafael Paper Mills (1,500 H.P.), mentioned in the report for 1907, commenced in October, 1908. The results for the six months to June 30th, 1909, show a marked improvement over those of the previous period. The net profits for that period amount to approximately £21,500 (nearly equal to the profits earned in the year 1908), and thus the bond interest for the same period—£21,891—is practically covered. The board consider that the outlook for the future is very promising. With the removal of the ruinous competition in the lighting business, a great improvement will be shown in the net profits of that department. The material increase in the profits of the power business during the first six months of this year should also be further augmented during the current half-year by the revenue from the power already sold or being contracted for. Being satisfied that it is now a practical certainty that the balance of the power available from the two Portesuelo Falls and the falls of the San Agustin Co. will be sold within the next two years, the directors have decided to proceed immediately with the partial development of the Tuxpango Falls (30,000 H.P., but say 25,000 H.P. to allow for abnormal dry seasons, such as the last season has been), so that the company will be in a position to meet the growing demands of the City of Puebla and the district served by the company.

Anglo-American Telegraph Co., Ltd.—The board has resolved, after placing £5,000 to the credit of the renewal fund, to declare an interim dividend for the quarter ending September 30th, 1909, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax, as last year, payable on November 1st.

South Metropolitan Electric Light and Power Co., Ltd.—Warrants for interest on the 4½ per cent. first mortgage debenture stock of this company for the half-year ended September 30th, 1909 (payable October 1st) have been posted.

Germany.—The Rheinisch-Westfalisches Electricitätswerk Gesellschaft, of Essen, is declaring a dividend of 8 per cent. for the last financial year, the same as for the preceding 12 months.

Brisbane Electric Tramways Investment Co., Ltd.—The directors will pay a dividend of 3s. 6d. each on the ordinary shares, in respect of profits for the half-year to June 30th, 1909.

Melbourne Tramway and Omnibus Co. (Australia).—A dividend of 4½d. per share for the quarter ending September 30th, is announced.

Messrs. Pirelli & Co., Milan.—The capital of this company is now 10,500,000 lire. The general meeting of the company, presided over recently by Signor Riva, was attended by 53 shareholders. The shares are 500 lire. It was decided to distribute 40 lire per share, and to carry forward 2,954 lire. The directors reported satisfactory work at the establishment in Milan, as well as that at Villanueva, near Barcelona; the latter is now almost in a position to undertake the construction of submarine cables. Negotiations are proceeding for the establishment of new works at Bicocca.

Prospectuses.—*New York Telephone Co.*—Messrs. Baring Bros. & Co., Ltd., have been before the British investor offering £2,009,000 of 4½ per cent. first and general mortgage 30-year bonds at 95. A further £500,000 is reserved for Amsterdam, and £2,500,000 for the U.S. The list was to close on 7th inst.

Carey United Rubber Estates, Ltd.—This company last week offered 100,000 shares of £1 each for subscription. The company is acquiring an estate at Kajang, F.M.S., which is "now yielding large returns," and will also acquire 5,000 acres of virgin forest from the Jugra Land and Rubber Estates, Ltd., and plant rubber thereon.

East African Rubber Plantation Co., Ltd.—An issue of 75,000 shares of £1 each was offered last week. The company acquires a number of plantations in the north-east of German East Africa.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Sept. 29	2,853	+ 37	17	26,686	— 521	..	..
Ayr	Oct. 2	561	— 17	20	8,108	— 73	8	..
Bath	„ 2	1,708	+ 42	39	30,770	+ 1,445	..	..
Belfast	„ 1	7,695	+ 284	25	101,792	+ 4,396	37	..
Birkenhead	„ 3	2,238	+ 7	26	28,926	— 398	18·63	..
Birmingham Corp.	Sept. 25	13,185	+ 186	26	167,697	+ 3,972	56·5	..
Blackburn	„ 25	2,254	— 10	27	30,647	— 852	13·97	..
Blackpool-Fleetw'd	Oct. 2	1,674	+ 117	13	18,877	+ 1,220	..	..
Bolton	„ 3	4,732	— 22	27	63,895	— 338	26	..
Bournemouth	Sept. 29	3,593	— 43	26	46,379	+ 283	21·96	..
Bradford	„ 25	9,932	+ 833	25	127,408	+ 3,583	54·81	..
Brighton	Oct. 3	2,111	+ 28	27	28,715	+ 1,336	9·5	..
Bristol	„ 1	9,975	+1,424	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Sept. 24	446	— 8	38	8,315*	— 83	3·65	..
Barnsley	„ 24	335	— 19	„	6,429	— 329	..	..
Barrow	„ 24	522	— 11	„	8,949	— 614	5·37	..
Cavehill	„ 24	212	— 41	„	3,453	— 79	..	..
Devonport	„ 24	749	— 231	„	14,114	— 3,529	8·85	..
Gateshead	„ 24	1,984	— 108	„	37,853	— 443	11·25	..
Gravesend	„ 24	474	+ 16	„	8,038	— 100	6·5	..
Greenock	„ 24	1,807	+ 256	„	21,319	+ 1,018	7·25	..
Hartlepool	„ 24	510	+ 22	„	9,060	— 187	6·72	..
Kidderminster	„ 24	237	+ 24	„	4,263	— 172	..	..
Leamington	„ 24	420	+ 18	„	6,810	+ 248	..	..
Merthyr	„ 24	423	— 14	„	8,184	+ 82	2·9	..
Metropolitan	„ 24	13,815	+1,069	„	247,565	+18,822	22	..
Middleton	„ 24	702	+ 41	„	13,030	— 883	8·5	..
Mid. Joint Com'tee	„ 24	11,698	+ 78	„	217,023	— 2,119	..	..
Oldham—Ashton	„ 24	1,140	+ 10	„	21,455	— 1,237	9·13	..
Peterborough	„ 24	242	— 32	„	40,536	— 876	5·31	..
Potteries	„ 24	3 809	+ 110	„	67,593	— 1,097	29	..
Rothesay	„ 24	548	+ 179	„	9,289	+ 177	2·75	..
Southport	„ 24	629	+ 9	„	11,401	— 275	8·17	..
S. Metropolitan	„ 24	1,789	+ 26	„	30,806	— 297	..	..
Swansea	„ 24	2,054	+ 114	„	36,989	+ 841	12·5	..
Tynemouth	„ 24	521	+ 56	„	9,943	+ 787	3·75	..
Weston-s-Mare	„ 24	415	+ 42	„	6,578	+ 406	3	..
‡Worcester	„ 24	613	— 26	„	10,808	— 128	5·75	..
Wrexham	„ 24	242	+ 11	„	3,802	— 136	..	..
Yorks. Wool. Dist.	„ 24	2,023	+ 130	„	34,858	— 71	17	..
Miscellaneous	„ 24	445	+ 18	„	8,083	+ 138	..	..
Burnley	Oct. 2	2,656	+ 247	..	..	..	..	..
Burton-on-Trent	„ 3	530	— 29	27	7,269	— 207	6·63	..
†Bury	Sept. 26	1.227	+ 64	25½	31,014	— 423	22·5	..
†Cardiff	„ 18	2,306	+ 101	25	56,285	+ 547	..	..
Carlisle	Oct. 2	354	— 56	39	6,562	— 821	..	..
Chatham and Dist.	Sept. 30	1,779	— 112	39	33,305	+ 1,628	14·98	..
Cork	„ 30	1,073	+ 63	..	17,570	— 604	9·89	..
†Croydon	„ 17	3,320	+ 502	..	38,417	+ 2,183	11·25	4·75
†Darlington	„ 25	180	— 21	26	4,854	— 863	..	..
Darwen	Oct. 1	486	+ 5	26	6,679	— 201	4·36	..
Dover	Sept. 25	455	— 25	26	5,966	— 398	4·75	..
Dublin	Oct. 1	11,232	+ 430	..	78,544	+ 1,478	54·25	..
Dundee	Sept. 29	2,404	— 25	19½	28,709	— 541	15	..
East Ham	Oct. 2	1,992	+ 116	26½	27,125	+ 3,571	8·52	·77
Exeter	..	..	..	..	..	..	..	..
Glasgow	„ 2	35,193	—2,386	..	301,208	— 4,077	94½	5
Hastings	Sept. 30	2,406	— 66	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	..	..	..	..	..	..	..	..
Ilkeson	Sept. 30	277	— 15	26	3,618	— 227	..	..
Ipswich	Oct. 2	862	— 29	27	11,582	+ 138	10·5	..
†Kilmarnock	Sept. 25	292	— 11	19	2,915	— 102	4·25	..
Lan'kshire Trm.Co.	..	..	..	..	..	..	..	..
Lancashire United	„ 29	2,757	— 12	39	52,182	— 446	39	..
Leeds	„ 25	13,783	+ 718	26	177,087	+ 4,033	54	6
Leicester	Oct. 2	4,537	+ 51	..	..	..	..	..
Leith	Sept. 26	1,201	+ 208	19½	12,347	+ 1,643	9	3
Liverpool	„ 25	21,741	+ 312	38	410,895	— 1,837	58 5	..
‡L.C.C.	„ 18	75,258	+1,847	..	896,195	+ 3,694	124·7	2·375
London United	Oct. 2	12,561	—2,370	..	242,261	—25,233	..	..
†Lowestoft	Sept. 18	280	— 5	51	9,593	+ 1,046	3·5	..
Manchester	Oct. 2	31,207	— 201	27	404,806	— 3,027	105	..
†Newcastle	Sept. 25	3,899	— 108	..	99,504	— 1,493	..	..
†Newport	„ 25	667	+ 25	26	17,367	— 311	14·5	..
†Oldham	Oct. 3	3,678	— 336	27	51,785	— 3,788	23·75	..
†Pontypridd	„ 2	838	— 25	26½	11,206	+ 1,030	5·5	1·75
†Portsmouth	„ 2	2,149	+ 12	27	60,832	+ 1,916	15·25	·75
†Preston	Sept. 29	1,497	+ 5	..	..	..	..	..
Rotherham	„ 30	1,166	— 70	25	15,020	— 703	10	·66
Salford	„ 27	9,469	— 1	25⅞	119,772	— 3,826	..	..
Sheffield	Oct. 3	11,885	— 57	27⅞	151,334	— 1,005	39·62	2·6
Southampton	Sept. 29	2,187	— 31	26	29,196	— 391	..	..
Southend-on-Sea	„ 29	1,117	+ 99	26	16,055	+ 2,317	..	..
†South Shields	Oct. 2	1,112	— 50	26⅞	15,454	— 60	..	..
†Swindon	Sept. 22	169	+ 13	..	..	..	..	..
Tyneside	„ 29	881	— 17	13	5,947	+ 267	..	..
Wallasey	Oct. 2	1,895	+ 76	26½	25 840	+ 690	..	·22
‡Walthamstow	Sept. 25	679	+ 25	26	17,981	+ 354	9	..
‡West Ham	„ 23	6,749	+ 387	25½	60,246	+ 3,881	15·43	·43
Wolverhampton	„ 29	1,839	+ 162	26	21,613	— 697	14·25	1·75
Baker St.-Waterloo	Oct. 2	6 915	— 280	13	88 025	— 70	4·25	..
Cen. London Rly.	„ 2	10,597	—6,299	13	64,808	—31,438	6·92	·55
Char. +, Bus. Hamp.	„ 2	7,410	+ 500	13	47,330	+ 4,970	7.75	..
City & S. Lon. Rly.	„ 3	6.258	+ 66	13	39,797	+ 1,286	7·3	..
Dublin-Lucan Rly.	„ 1	324	+ 33	13	2,177	+ 72	7	..
G.N. and City Rly.	„ 2	2 685	+ 7	13	16,424	— 31	3·5	..
G.N., Py. & Brmin.	„ 2	10,735	— 40	13	64,460	+ 450	9·25	..
L'pool Overh'd Rly.	„ 3	2,652	— 117	13	20,232	+ 55	6·2	4·2
†Llandudno-Col. Bay	„ 1	604	+ 99	44	13,054	+ 2,152	..	..
Mersey Railway	„ 2	4,046	+ 198	13	25,049	+ 963	4·5	..
Metropolitan Rly.	„ 3	33,581	—2,861	..	205,682	— 3,382	24·5	..
Met. District Rly.	„ 2	19,672	+ 107	13	122,675	+ 5,451	24	..
Anglo-Argentine	Sept. 30	79,296	+3,805	..	1,521,564	+22,730	..	..
‖Auckland	„ 10	13,093	+ 195	36	122,707	+11,020	22·2	1·38
Bombay (B.E.T.)	„ 2	5,185	+ 399	35	87,785	+ 5,377	..	..
‖Brisbane	..	..	..	..	..	..	..	..
‖Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Oct. 2	6,623	— 277	..	..	..	..	..
‖Cape Electric T. Ld.	..	..	..	..	..	..	..	..
‖Kalgoorlie, W.A.	..	..	..	..	..	..	..	..
Madras	Sept. 30	1,259	+ 115	39	22,929	+ 621	..	..
‖Melbourne	..	..	..	..	..	..	..	..
‖Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.)	Oct. 1	2,750	+ 132	39	54,549	+ 527	26	2·92

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. ‖ One month.

STOCKS AND SHARES.

Tuesday Afternoon.

In many markets of the Stock Exchange there is quite a lot of business doing. Rubber shares and land shares monopolise the greater part of attention amongst miscellaneous issues. A valiant attempt to infuse vitality and strength into some of the Home Railway stocks met with slender success, and the most that can be said is that prices have rallied above the worst.

It is more a matter of melancholy curiosity than anything else, to record that East London Ordinary stock changed hands this week at a lowly 50s. per cent., while the "D" Debenture stock was dealt in on the same day at 60s. The "C" Debenture stands nominally at 6, and the "B" can be picked up at about 19. The delay in the opening of the newly-electrified section of the London, Brighton and South Coast Railway has, no doubt, induced some luckless East London stockholders to realise, since it is to the Brighton Company's system of traction that the little East London is looking to take an example for its own long-talked of electrification.

Metropolitans and Districts are down ¼, and City and South London fell ½, these being the only quotable changes in the electric railway list.

The feature amongst electrical supply shares is a sharp rise in River Plate Ordinary. For some time past, all the shares which came to market were steadily absorbed, and now that the supply has become limited, the effect of the company's increasing prosperity is fairly reflected in the quotation. Another advance worthy of notice is that of $\frac{1}{16}$ in Victoria Falls Power Preference, a movement intimately bound up with a dramatic rise in the price of the generally-popular Chartered shares. The home group is very quiet, and except for a few *ex* dividend markings, the changes hardly deserve attention.

Mexican Light and Power bonds have benefited substantially from the various evidences produced as to the precise amount of damage done at Necaxa, and there is also a rise of 1 in the 5 per cent. Gold bonds of the Mexican Electric Light Company. Mexico Tramways Common stock has recovered more than its decline of last week, and here again the bonds are strong. Other issues in this section are mostly a trifle firmer, small gains being obtained by Sao Paulo Trams at 150½, *ex* 2½ dividend, and Rio Trams at 94. Canadian General Common at 122½ is *ex* 1¾ per cent., and the Preference at 119, *ex* 3½ per cent., shows a point rise.

British Columbia Preferred Ordinary stock continues to ascend steadily, a further rise of 2 bringing the price to 122½. Anglo-Argentines are steady; Calcutta Tramways Debenture again rose a point. British Electric Traction Second Debenture has eased off, and Underground Electric Railway Income bonds slid back a little further.

Telegraph securities have moved somewhat irregularly. The Anglo-American gamble has quieted down considerably, speculation drifting into other channels. The price of the Deferred has gone a little easier. The Commercial Cable Company is reported to be having trouble with the Newfoundland Government in reference to the laying of certain pipes for conducting cables, and the matter in dispute is said to have been referred to the United States Government. Whatever the upshot, it is not likely to affect the company's 4 per cent. Debenture stock, quoted here at 90, *ex* dividend, last week. American Telephone and Telegraph stock is better on balance, allowing for the dividend payment, and the Mackay Companies' stocks have moved in directions opposite to each other. An issue of New York Telephone bonds was taken like the proverbial hot cakes, the subscription lists being open for less than two hours.

Marconi shares fell to 15s. upon the announcement that the company had received £15,000 from the Government for that part of the undertaking recently taken over. In the market the price is regarded as very disappointing, and the inspired statements in the newspapers, making the best of the matter, failed to brace up the quotation. Probably the proprietors are able to estimate for themselves the value of the payment, which, by the way, was on account of one of the sources of steady profit to the concern.

National Telephones are better. Orientals have gained $\frac{1}{16}$, and the new United River Plate shares rose to 1⅛ premium.

The Manufacturing list is steady on the whole. Willans and Robinson issues are flat, reflecting the unsatisfactory condition revealed by the report. General Electric Preference rose ¼, and Castner-Kellner Debenture improved a point. Rubber shares have been fluctuating with some degree of violence, but prices manage to maintain the greater part of their strength, and so long as the product itself can be held up at an artificially-inflated price, the danger of a severe market-slump will not be very great.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Sept. 28th.	Closing Quotations Oct. 5th.	Business done week ended Oct. 5th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅞ — 3⅛	2⅞ — 3⅛	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	93 — 96	93 — 96	..	..	..	5 4 2
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	147 —149	146 —148	147	..	..	5 7 5
$18,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	97 — 99	98	97½	..	4 1 8
558,460	Anglo-American Telegraph	Stock	5½%	5½%	5½%	£3 4s.	61¼ — 63½	61¼ — 63½	62	..	..	5 2 3
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	104 —105	104 —105	104⅜	104	..	5 14 3
3,220,770	Do. do. do. Deferred	Stock	1½%	12½%	1 %	8/-	21⅞ — 22⅛	21⅞ — 21	22 1/16	21⅛	— ⅛	1 16 4
47,795	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8⅜	8 — 8⅜	..	..	..	4 14 1
2,481,350	Commercial Cable, Sling. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	90 — 92	89 — 91	90	89½	—1	4 7 11
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8¾ — 9⅛	8¾ — 9⅛	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17½ — 18½	17¼ — 18½	18½	..	..	5 9 7
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¾ — 8⅞	8 — 8½	8 7/16	..	— ⅛	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½ —102½	100½ —102½	..	..	..	2 3 11
60,710	Direct United States Cable	20	4½%	4½%	4½%	4½%	13½ — 13⅝	13½ — 13⅝	13 5/8	13 1/16	..	7 4 8
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,300, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	129 —132	129 —132	131	129½	..	5 6 10
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	85 — 87	85 — 87	86	85½	..	4 0 6
1,996,708	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	104 —106	104 —106	..	..	..	3 15 6
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅞ — 12½	11⅞ — 12½	12⅛	11⅞	..	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
200,000	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 3,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	5½%	10½ — 10⅝	10½ — 10⅝	..	..	— ⅛	5 8 3
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13⅝ — 14⅛	13⅝ — 14⅛	..	..	— ⅛	4 4 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	26 — 27	26 — 27	26 5/8	..	..	b 13 4
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½ — 53½	51½ — 53½	53½	..	..	6 1 6
$41,880,400	Mackay Companies Common	$100	2 %	5½%	4 %	4 %	95 — 98	94 — 97	96¼	..	—1	4 2 6
$58,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	79 — 81	80 — 82	..	..	+1	4 17 7
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	3/16 — 7/16	1/16 — 1/8	15/-	13/9	— 1/16	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	7/8 — 1	7/8 — 1	..	..	..	6 17 2
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	7/8 — 1	7/8 — 1	..	..	..	5 14 3
2,226,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 —107½	106¼ —108	107	..	+ ⅛	5 11 7
5,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	121 —123	121 —123	122½	121½	..	4 17 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 10⅝	10½ — 11	10⅝	..	+ ⅛	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10¾ — 10⅞	10¾ — 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 1/16 — 5⅛	5 1/16 — 5⅛	..	..	..	4 7 3
2,000,000	Do. do. 8½ % Deb. Stock Red. ..	Stock	8½%	8½%	8½%	8½%	98 —100	98 —100	..	..	..	3 10 0
1,988,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,312	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	14⅜ — 14⅝	14⅜ — 14⅝	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref.... ..	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 1/16 — 1 1/16	24/9	..	+ 1/32	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87½	..	..	4 13 0
99,400	Pacific & European Tel., 4 % Guar. Debr., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839	Reuter's	2	5 %	5 %	5 %	5 %	7 15/16 — 8¼	7 15/16 — 8¼	..	..	..	4 17 7
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100¾ —102⅛	100⅛ —102⅜	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	131 —134	131 —134	..	..	..	4 9 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6 1/16 — 6 1/8	6 1/16 — 7	6 1/16	6 1/16	+ 1/16	5 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000 ..	5	5 %	5 %	5 %	5 %	5 1/16 — 5⅛	5 1/16 — 5⅛	5⅛	..	..	4 8 10
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	2½%	1 1/16 — 1 1/8	1 1/16 — 1 1/8	32/6	31/10½	+ 1/16	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	7 %	13⅜ — 13¾	13⅜ — 13¾	13⅝	13 3/8	..	5 0 10
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16 2
88,821	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	15/7½	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8⅞ — 9⅛	8⅞ — 9⅛	9⅛	8 15/16	..	6 9 9
4,689	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£3 6	15 %	8½ — 9½	8½ — 9⅝	..	..	..	15 15 10
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101⅛ —103⅛	101¼ —103⅛	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅜ — 4⅝	4⅜ — 4⅝	95/7½	92/6	..	5 2 4
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4¼ — 4⅜	4¼ — 4⅜	92/6	91/-	..	5 17 8
978,280	Do. 4 % Deb. Stock	..	..	..	..	4 %	92½ — 93½	93½ — 93⅝	93	93⅜	..	4 5 10
382,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
580,000	Babcock & Wilcox, 1 to 580,000..	1	20 %	20 %	20 %	20 %	4½ — 4⅝	4⅜ — 4½	92/6	89/4½	— ⅛	4 8 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	1 — 1⅛	1 — 1	..	..	..	35 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜ — 3¾	3⅜ — 3¾	..	..	..	7 10 11
12,997	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2¾ — 3⅛	2¾ — 3⅛	50/-	..	..	5 14 3
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	144 —149	144 —149	146	..	..	5 7 5
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	118 —123	120 —125	123½	123	+2	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	106 —110	106 —110	109⅜	..	..	4 10 1
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,000	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
133,801	British Electric Traction	10	5 %	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	11/8	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	14%	1⅛ — 2⅛	1⅛ — 2⅛	40/-	37/6	..	6 9 9
1,478,558	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 — 87	84½ — 84½ xd	82½	..	..	6 18 4
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	63 — 67	62 — 66	..	..	—1	6 16 4
100,000	British Insulated and Helsby Cables	6	8 %	10 %	10 %	10 %	7⅛ — 7⅝	7⅛ — 7⅝	7⅛	7 1/16	..	6 10 2
100,000	Do. do. 6 % Cum. Pref.	6	6 %	6 %	6 %	6 %	6⅜ — 6½	6⅜ — 6½	..	..	..	4 11 3
500,000	Do. do. 4½ % 1st Mort. Deb. Red.. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
804,940	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 300,000 and 375,001 to 475,000	5	Nil	Nil	Nil	Nil	3/16 — 1/4	3/16 — 1/4	..	..	..	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 42	38 — 42	..	..	..	9 10 6
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	24%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
900,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	42½	41½	..	9 15 8
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 3 9
45,804	Do. 5 % Cum. Pref., Nos. 1 to 20,330..	5	5 %	5 %	5 %	5 %	4⅜ — 5	4⅜ — 5	96/3	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	98 —101	99 —102	102	..	+1	4 8 3
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10⅜ — 11⅛	10⅜ — 11⅛	..	..	..	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,229	Cape E. Trams., 1 to 491,229	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2 — 2⅛	2 — 2⅛	42/-	41/-	..	5 17 8
710,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	105 —108	106 —109	..	..	..	3 13 5
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	61 — 63	61 — 63	61½	61⅛	..	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 14 2
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	43 — 45	43 — 45	45	..	..	5 11 1
1,480,000	City and South London Railway	Stock	1¾%	2½%	2½%	1½%	31 — 32	30½ — 31½	30½	..	— ⅛	4 15 3
85,000	Crompton & Co., Nos. 1 to 85,000	5	5½%	5 %	5 %	5 %	1 — 1⅛	1 — 1⅛	..	..	..	13 6 8
180,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £180, and 901 to 11,999 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(Continued)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Sept. 28th.	Closing Quotations Oct. 5th.	Business done week ended Oct. 5th, 1909. Highest	Lowest	Rise + or Fall —	Present Yield per cent. £ s. d.
250,000	Dick, Kerr & Co., 1 to 250,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	..	..	—1/16	8 17 9
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1⅛ — 1⅛	1 1/16 — 1 1/8 xd	..	..	..	4 14 1
271,080	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12⅜ — 13⅜	12⅜ — 13⅜	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½ %	4½ %	2½ %	1½ %	1/16 — 1/8	1/16 — 1/8	..	5/-	4/3	24 0 0
17,189	Do. "A" shares, 01—017,189	5	4½ %	4½ %	2½ %	2½ %	1 — 1⅛	1 — 1⅛	..	20/-	..	8 6 8
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	68 — 70	68 — 73	..	..	..	5 9 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	84 — 87	82 — 85 xd	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1⅛ — 1⅛	1⅛ — 1⅛	..	..	..	9 13 1
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7⅞ — 8⅛	8 — 8⅛	8⅛	..	+ ⅛	5 17 8
300,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 88	83 — 87 xd	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½ %	Nil	¾ — 1	¾ — 1	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10⅛ — 10⅜	10⅛ — 10⅜	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103⅛	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12½ — 13½	12½ — 13½	12½	..	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	106 —108	106 —108	..	..	..	4 3 4
60,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	10 %	14⅜ — 15½	14⅜ — 15½	..	..	..	6 13 4
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	⅛	Nil	3/16 — ¼	3/16 — ¼	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4⅞ — 5	4⅞ — 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 60,007	10	8 %	8 %	8 %	Nil	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
299,980	Do. do. 60,008 to 100,000	10	8 %	8 %	8 %	Nil	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3⅜ %	2⅛ — 2⅜	2⅛ — 2⅜	50/-	..	..	18 12 8
1,381,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	..	4 %	67 — 70	67 — 70	..	..	..	5 14 4
5,732,063	Metropolitan Consolidated	100	2½%	1 %	½%	½%	38½ — 38⅝	38 — 38½	38⅝	38½	— ½	1 6 0
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	65 — 67	65 — 67	65	..	..	4 2 1
5,236,000	Do. District	100	Nil	Nil	Nil	Nil	16 — 16½	15⅞ — 16⅛	16⅛	15⅞	— ⅛	Nil
391,897	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	3/16 — ¼	3/16 — ¼	..	..	..	..
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
600,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/16 — 1/8	1/16 — 1/8	..	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	94½ — 95⅝	94½ — 96⅛	..	..	..	4 13 3
10,823,300	Mexico Trams Co., Common Stock	..	..	..	..	..	125 —128	127 —130	128⅞	128	+2	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	90 — 92	92 — 94	93½	92½	+2	5 6 5
345,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅛ — ¼	⅛ — ¼	..	..	..	..
345,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅜ — ½	⅜ — ½	..	..	..	6 17 11
345,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89	..	..	..	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34½ — 36	35⅝	34½	..	5 0 0
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	101	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	102½—103½	102¾—103½	103½	103	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	87 — 89	88	87½	..	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	35 — 37	34 — 36	..	..	—1	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜ — ½	⅜ — ½	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2⅜ — 2⅝	2⅛ — 2⅝	..	..	—⅛	2 3 9
945,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	78 — 82	76 — 80 xd	78	77	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

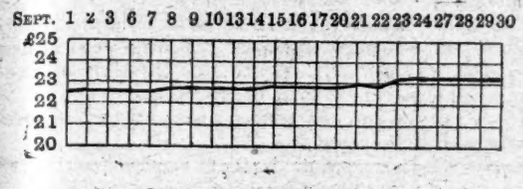
15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4½— 4⅝	4½— 4⅝	..	..	— ⅛	5 12 1
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 30,000	5	10 %	10%	10 %	10 %	7½ — 7⅝	7½ — 7⅝	7½	..	..	6 9 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅞ — 8	7⅞ — 8	..	..	..	4 7 6
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½ — 5	4½ — 5	90/-	..	..	4 10 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	3 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅞ — 4	3⅞ — 4	..	..	..	5 12 6
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,598	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅛ — 11	10⅛ — 11	10 1/16	10⅛	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅜ — 12⅜	11⅜ — 12⅜	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 11⅝) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	102⅜	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1⅝ — 2	1⅝ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3 — 3⅛	2⅞ — 3⅛	..	..	— ⅛	7 8 2
250,000	Do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93½ — 95½	93½ — 95½	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ — 8⅛	7⅝ — 8⅛	7 7/8	7⅝	..	6 1 3
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	11	10 13/16	..	5 7 10
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	104 —107	104 —107	107	..	..	4 4 1
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	101⅜	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛ — 3/16	⅛ — 3/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	58 — 61	57 — 60	57	..	—1	7 10 0
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 5	4⅝ — 4⅞	..	..	— ⅛	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	4⅞ — 5⅛	..	..	— ⅛	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅜ — 7⅝	7⅜ — 7⅝	..	..	..	5 11 6
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	98 —101	99 —101	100⅛	100	..	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7 — 7⅛	7 — 7⅛	7	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	5	4 %	4 %	2½%	3 %	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5 — 5⅛	5 — 5⅛	..	..	..	5 17 1
682,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	93 — 97	93 — 97	..	..	..	4 2 6
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4 — 4⅛	4 — 4⅛	88/9	87/6	..	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	..	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
248,000	Do. 5% Mort. Deben. Stock Redem.	Stock	5%	5%	5%	5%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$5,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80 — 82	81 — 83	82½	81½	+1	6 0 6
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	70 — 74	70 — 74	72½	71	..	4 14 7
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	102 —106	102 —106	104	103½	..	6 12 1
$12,000,000	Do. do. 5% 1st Mtg. Gold Bonds.	..	..	..	..	5 %	83½ — 85½	86 — 88	87	85½	+2½	5 16 8
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 99	97 —100	..	..	+1	4 10 0
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	8 %	2½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	2 14 0
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4⅛ — 5⅛	4⅛ — 5⅛	..	..	..	4 15 3
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 —101	100 — 102	..	..	+1	..
10,863	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12½ — 13½	12½ — 13½	..	..	..	5 6 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6⅛	6 — 6⅛	..	..	..	5 7 8
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,894	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	2½%	2½%	6 %	8 %	1⅝ — 1 7/8	1⅝ — 1 13/16	81/-	80/-	..	5 6 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 10 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8⅝ — 9⅛	8⅝ — 9⅛	..	..	..	6 7 0
70,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	..	..	..	4 11 10
150,000	Do. do. 8½ % Deb. Stock Red.	100	8 %	8½%	8½%	8½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	1/16 — ⅛	1/16 — ⅛	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	5 %	4 %	5 %	2⅝ — 3	2⅝ — 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	1/16 — 1/8	1/16 — 1/8	3/9	..	..	4 8 11
149,988	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1 1/16	1⅛ — 1 1/16	22/6	..	..	5 17 11
294,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102—105	100 —103 xd	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	6 %	6 %	6 %	¾ — 1	⅞ — 1 xd	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	6 %	5 %	1⅛ — 1⅜	1⅛ — 1⅜ xd	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	77 — 81	74½ — 79½ xd	..	..	..	5 14 8
608,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	3/16 — ¼	3/16 — ¼	19/4½	18/6	..	5 9 7
110,000	Westminster Electric Supply, Ord.	5	12 %	12 %	10 %	10 %	8½ — 9	8½ — 9	8⅝	8½	..	5 11 1
81,979	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	5 1/16	..	..	4 8 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

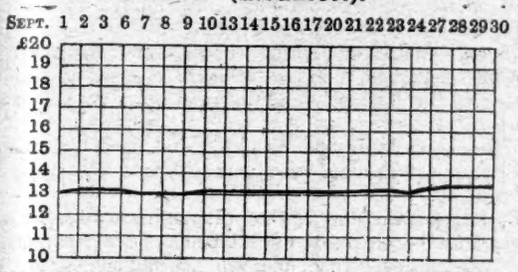
METAL MARKET.

Fluctuations in September.

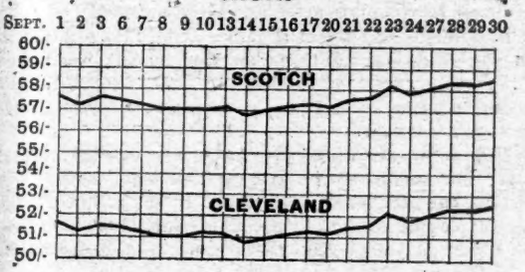
SPELTER (G.O.B's.).



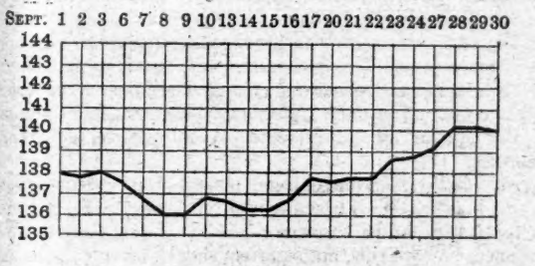
LEAD (ENGLISH).



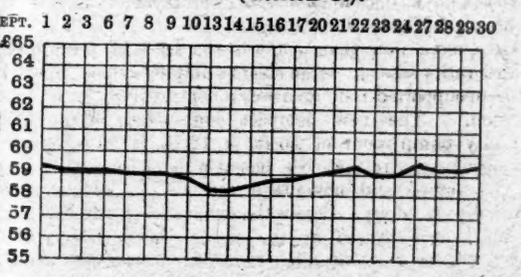
IRON.



TIN.



COPPER (G.M.B's.).



The Electrical Treatment of the Insane.—A correspondent writes that the use of electricity for the treatment of the insane was successfully demonstrated at Cardiff last week, when Dr. Goodall, the superintendent of the Cardiff City Mental Hospital, informed his committee that he had given electric treatment to a patient who had been removed from another institution to the Cardiff Asylum. She had been unable to move from bed for some time, but was able to get up in three days after being electrically treated, and in three weeks afterwards had recovered sufficiently to be liberated.

NOTES ON ELECTRIC PRACTICE IN MINES.

By W. O. PEPPER.

Electricity is now generally admitted to be a practical and efficient power agent in mines, and its adoption is increasing daily.

Accidents from shock and, in a few cases, from fire, have cast a certain amount of stigma upon it—to some extent retarding its more general adoption in the past; but competition, together with the operation of the Eight Hours Act, will have an important influence in favour of its general use in the near future. There are now so many excellent examples of properly equipped electrical plants working in collieries, that the fears originally created by careless and indifferent design are bound to die a natural death.

To-day a well-designed scheme, run and maintained in an efficient manner, is, for all practical purposes, as safe as the safety lamp. A motor or a lamp, handled carelessly in a fiery mine, is equally dangerous. With care, both are efficient agents in winning coal.

The modern colliery plant is almost exclusively three-phase alternating, which, for many reasons, is by far the best. These notes will deal chiefly with the three-phase type, with occasional mention of direct-current apparatus.

The pressures, where alternating currents are generated, have considerably increased in the last year or two—going up as far as 3,000 volts for underground work. Alternating currents are particularly flexible, being easily transformed by stationary machinery to the pressure decided upon as the most suitable for a given mine.

Frequency is not a deciding factor in mine work, and may be dismissed by remarking that 40 or 50 is the frequency generally adopted.

Power House.—From the electrical standpoint there is no difficulty in laying out the generating plant to withstand the heaviest work called for at a colliery. The capacity of the engine and generator should err on the generous side, as an induction-motor load makes heavy demands on generator and mains. One feature calling for special attention in a colliery power station is the provision of a good automatic regulator. With an induction-motor load it is extremely important to supply the motors at their proper voltage, as the torque falls off rapidly with the pressure.

Apart from these points, the power station calls for no special mention, following the lines of the best central station practice.

Cables.—The transmission circuits in a mine are, perhaps, the weakest links in the electrical chain. The cables are generally carried along the sides of the roadways and near to the roof, suspended by leather or canvas strips from the pit-props. They are thus exposed to falls of roof. In the shaft water is the chief source of trouble, but there is also considerable danger from falling objects, a not infrequent occurrence.

The cables most favoured are the vulcanised bitumen make—double-armoured for the shafts and single-armoured for the roadways.

Closely running these in favour is the paper-insulated lead-covered and armoured type. The advantages claimed for this latter class are that the lead affords a water-tight sheathing, an extra mechanical protection and a means of effecting a better earth connection. The lead is, however, easily damaged, and when damaged it is difficult and sometimes impossible to repair it. The paper insulation is very soon rendered useless when moisture enters it. On the other hand, the vulcanised bitumen cable has splendid moisture-resisting properties, and the armouring affords a good earth. Where an additional earth is required, the following method gives good results, and at the same time is inexpensive. Old haulage and winding ropes are requisitioned and connected to the earth at the pit top by means of any water or other mains in the shaft, and also by the water in the lodge rooms. They are then carried into the roadways and slung high up on the sides, and run to all the main transformer and motor houses. From these ropes the electric cable is slung with light wrought-iron hangers in the form of a rough catenary suspension. By close spacing, all strain is taken off the

cable, and it lies more or less horizontally. This method also saves a considerable amount in the length, as ordinarily a free sag is allowed to prevent rupture in the event of the roof falling in. But the chief object of this suspension is to ensure a good earth for motors and apparatus in-bye, and at the face. This method has been adopted in a small way with good results.

The Home Office Regulations at present do not permit the use of metallic hangers. As, however, this method ensures an effective earth, permission would very likely be readily granted. If generally adopted, a light but sufficiently strong plough steel "messenger" wire should be used with as few joints as possible to ensure continuity.

For portable motors a special wire is run from the nearest switch pillar or motor house.

Great care must be taken in coupling the earth wire to the earth plates. The wire ropes are easily spliced by men skilled in the work in pits.

Switchboards.—There are now many excellent types of switchboards for underground work, self-contained and strongly enclosed. Interlocking devices prevent any access to live parts.

The framework of a panel or switch should never be built into the walls, as squeezing and rising of floors is always going on to some extent. Each panel, or group of panels, should have a certain amount of freedom to follow these movements; otherwise straining will ensue, and prevent the blades of a switch from making proper contact.

All switches, circuit-breakers and controllers should be immersed in oil, even with direct current.

Direct-current switchgear is receiving more attention from designers, and its immersion in oil is meeting with great success.

A direct-current arc is more difficult to break and confine than that of an alternating current. The alternating arc breaks at zero value, and its intensity diminishes as the frequency increases; thus an arc at 60 periods is easier to confine than one at 25 periods. A direct-current arc is more prolonged and vicious. An effective magnetic blow-out together with immersion in oil will add greatly to the safe use of direct-current switchgear.

A convenient form of circuit-breaker to adopt for use in mines is the compact tramway type. This is very suitable for coal-cutters, and fuses for this work are rightly being abandoned. Controllers for coal-cutters should be fitted with a strong ratchet device to ensure uniform starting. Reliable automatic overload cut-outs are plentiful, and should replace all fuses. Fuses for induction motors are anything but reliable as a means of protection against ordinary overloads. They have to be large enough to carry four or five times full-load current at starting; they are, therefore, useless for ordinary troubles.

The same difficulty applies to an A.C. overload circuit-breaker. This difficulty is not insuperable. Some mechanical device can be arranged to throw the relay catch out of gear whilst switching in. When the motor has attained full speed, the relay can be released and set to operate at a suitable overload.

The lines of all switchgear should be as simple as possible, dust and dirt-proof, and contact with a live part impossible.

Where a switch and controller immersed in oil are combined in one case, and there is much starting and stopping, efficient ventilation is important. The fumes rising from the carbonised oil should be allowed a free exit, due care being taken that no flame can escape. If the oil is at its correct level there will be no escape of flame.

An ammeter should be provided with every motor-panel above 10 H.P., and a voltmeter or lamp to indicate whether pressure is on as soon as the isolating switch is closed.

In a fiery mine, remote control of any motor, that is, starting up a motor which is out of sight of the man in charge, should never be allowed.

Transformers.— For underground work oil-immersed transformers are in general use, and should be the only type employed. Oil sights should be fitted and frequently inspected; unless this is attended to, trouble follows, either through creeping and sometimes overflowing, or through overheating if the level is too low.

Earthing the neutral of transformers when star connected is sometimes done, but more often not. It is perhaps better not to earth it, as there is often trouble with instruments and other small auxiliaries if earthed.

Transformers in mines should not be connected in delta, as with this connection it is possible for motors to continue running with a defective phase. In a mine no apparatus should be allowed or able to continue to run under such conditions.

The employment of good static earth detectors, in conjunction with a frequent insulation test by a good Megger or Ohmer, will generally indicate the state of the cable system and detect any gradual deterioration.

If all casings are well earthed there will not be much danger of shock to person.

Lighting.—It is generally better to employ special transformers for lighting—stepping down to 50 or 25 volts.

All motor houses should be liberally lighted, the wiring being slung on insulators and in sight.

Motors.—With alternating current the squirrel-cage induction-motor is the ideal one. It is, however, handicapped by its low starting torque, and heavy current consumption at starting.

Where heavy loads must be started, and speed variation is necessary, as in hauling, the slip-ring, wound-rotor type is adopted.

By means of the slip rings and external resistance, any slip or speed can be obtained. This type has also the advantage of a high starting torque, and will not fall out of step, as the maximum effort is not reached till the motor is nearly at rest. As a variable speed motor it is not efficient, and should be run up to speed as soon as possible.

The squirrel-cage motor is more adapted to centrifugal pumping conditions and to endless rope haulage where full-load effort is not suddenly thrown on it. This type should be adopted wherever possible, on account of its simple and robust construction.

Synchronous motors do not find much scope in mining work. For small powers they are, perhaps, out of the question, but the larger sizes can be well adapted. The chief drawbacks are that more skill is required to start them, and surging or pumping occurs when heavy loads disturb the line.

But even with these defects, they are always justified in the case of a fan drive, which is in continuous service and forms a perfectly steady load.

The great saving, by the increased power factor, in the generator capacity and line losses will easily compensate for their apparent delicacy. This saving amounts to about 15 per cent., and in some instances, where the other motors on the system are well loaded, to 20 per cent. in the generator.

Coal Cutters.—Squirrel-cage motors are proving best in this branch. With liberal power on the generator, motors up to 15 H.P. can be thrown on the line without undue disturbance. Above this, auto-starters should be employed.

Winding.—The advantages of electricity for underground purposes are at once apparent to even the most conservative of mine proprietors and managers.

Cost, more often than not, was the least of the problems in excavating the old large steam pumping rooms, where the large unsupported roof area was a continual source of apprehension. The new compact high-speed 60,000-gallon capacity pump room of 16 ft. × 12 ft. × 10 ft. means a saving not only in first cost, but also in worry.

The saving and advantage are not so apparent when applied to winding. Lately the exhaust and mixed-pressure turbines have covered up the multitudinous defects of the steam winder, thus retarding the steady advance of the electrical method.

It cannot be disputed that where a bulk supply, or a large power plant supplying a group of collieries, is at command, the electrical wind proves itself a really practicable system, and in conjunction with the general adoption of electrical plant at the pits is the means of effecting very great economies.

Electrical machinery is to-day as reliable and durable as other classes of machinery. It is more flexible and more easily controlled, and in view of present-day conditions affords the best means of meeting competition safely and profitably. The plant must be of the best quality, and under skilled supervision.

SIMPLICITY IN DESIGN.

By ALINGTON JOHNSTON.

It is not my intention here to apply the above heading to any individual piece of plant or apparatus, electrical or mechanical, although simplicity should be the aim and object in machinery of every description, if it is to have any commercial value.

The heading of this article is more in view of the general arrangement and lay-out of individual pieces of machinery and their adjuncts, in order to form the simplest and most efficient grouping possible from an operative point of view.

My intention is to show how necessary it is to adopt the most simple methods as regards both the steam and the electrical side of a large generating station, so as to facilitate quick and easy operation and low maintenance. Only too often we see this object totally disregarded, and the plant a source of annoyance and trouble to those who have charge of the undertaking.

Simplicity is often absent due to governing factors, and difficulties arise which cannot be surmounted, try as you will.

One of the greatest factors is the site of an undertaking. For various reasons, we are not always able to pick and choose, and in a crowded district a site may be settled upon which has distinct disadvantages, but is the only one available; sooner than delay the scheme the ground is bought, or leased, and erection started. As the site is not all it might be, it is likely that the delivery and handling of coal will be complicated, and a good water supply difficult to obtain without elaborate arrangements with regard to pipe-work and pumps. These items and others all tend to complicate the running of a station, and add heavy maintenance charges.

Putting aside the above case, we will consider a site which has advantages instead of disadvantages—facilities for coaling, adequate water supply, and unlimited space. Here is an opportunity. The general lay-out of the buildings and plant should be such that access is easy to all parts, and no complications should arise. Bear this in mind, and a sound and creditable engineering feat will result.

The engineer's specification undoubtedly plays the most important part, and is the oracle to which both parties turn, contractor and engineer, in times of uncertainty.

Specifications should be made as short as possible, and to the point, stating exactly what is required in clear, concise terms, and not written like a technical book.

A specification is not intended to teach a contractor his work, but to show him the essential points which his machine or machines *must* fulfil, and without which they will not be accepted. Leave him to supply a good sound piece of work, which he will do for the sake of his own credit and future business.

Be careful in arranging the contract for the plant, and avoid having a number of different firms to do the work. A multitude of sub-contractors is conducive to chaos of the worst kind. With numerous sub-contractors the work is very often prolonged beyond the specified date of completion, and from start to finish is a cause of annoyance to everyone concerned. No one knows where his work begins or leaves off.

Suppose we assume the generating station to be modern and up to date in every respect, and to consist of steam turbines driving generators to supply current at high pressure over a large area. There are then three divisions of work to be considered: the boiler house, the turbines and generators, and the switchgear.

Let these three divisions represent three separate contracts, and the firms who get the work in each case will be the only people known from start to finish.

This *is* possible, as a firm tendering for the boilers would be in a position to supply most of the boiler-house plant. There are well-known firms who do this. The above also holds good with regard to the engine room. The third and last division—namely, high and low-tension switchgear, instruments and cable work pertaining to this contract—could also be done by one firm. I do not claim that the plan can be carried out in its entirety, but it could to a very great extent, and would simplify matters immensely.

Here is an example in my own experience of the equipment of a boiler house *alone*. The sub-contractors numbered *eight*. The result was, that with few exceptions, none of the work came into line. It was altered and rearranged time after time, and the confusion of mind and matter was parallel to the building of the Tower of Babel.

Another essential item is accessibility. It is often totally disregarded, and the plant, especially basement plant, is so terribly congested that it is with the greatest difficulty that repairs and running operations are carrried out.

We must not lose sight of the fact that there is generally an expensive overhead traveller in an engine room, which is not put there for the sole purpose of dealing with the erection of the plant, but is intended to handle, as far as possible, all machinery, big and small, in the station; and if machinery is congested and tucked away under concrete floors and in odd corners, or in among a mass of pipework, the traveller is not of much use. Heavy lifting tackle, and all sorts of unnecessary "fakes" are employed instead, entailing inconvenience and delay.

The grouping of plant is a most important question, and should be so arranged, as far as circumstances will permit, as to allow of a direct lift for the engine-room crane. Unnecessarily heavy floors of steel joists and concrete and badly designed foundations are generally responsible for difficulty of access.

The tendency in present-day practice is to keep this important point more in view, and instead of the basement being a dungeon, with no head room and "boxed" in, there are large open spaces left protected on the engine-room floor level by hand-rails. The covering, where a floor is needed, is composed of neat gratings, which can be easily removed to get at any machinery situated beneath.

Nearly all running plant in connection with the condensers and water supply can be installed in accessible places if forethought and common sense are exercised. The items which are most abused, and which come as afterthoughts in many undertakings, are pipework and provision for running cables and small wiring. The last is treated as quite an insignificant detail, but what looks more unsightly than badly-arranged cable runs? If the auxiliaries are all motor driven, as they would be in a modern station, a large amount of wiring is required, and if provision for direct runs has not been made in the building and foundations, a great deal of trouble and ugly work is the result.

It is my opinion that in the design and lay-out of central stations, more than in any other branch of engineering, we neglect past experience, and allow mistakes to occur which have already been proved bad practice, and have hampered schemes of a like nature in the past. There can be no turning back, for this would bring disaster to everyone concerned. So the undertaking drags on with a veritable millstone hanging from it, in the shape of heavy maintenance and repairs and low economy in the plant.

TURBO-ELECTRIC PROPULSION.

By A. P. CHALKLEY, B.Sc.

The following reference to electro-mechanical propulsion appeared in the *Financial News* of August 25th. It is these hasty and inaccurate statements which are most harmful to new projects, since people believe them to be based on real grounds, and it will be as well to point out some of the many fallacies which occur—indeed, it would be hard to conceive more false conclusions in so short a passage:—

Turbo-Electrical Propulsion.

In reference to the suggested turbo-electrical propulsion for steamships, a correspondent writes pointing out some of the difficulties which would have to be overcome before such a system could be rendered practicable. The most serious objection, he says, is the liability of electrical insulation to break down from dampness, and a ship's main driving power may become utterly useless from a small cause. If large quantities of water obtain access to the engine room, serious results must follow, and while any form of mechanical propelling agency may be repaired at sea, there is little hope of coping with an electrical breakdown. Further, the design of the main motors seems a formidable task. The main

result is efficiency at sea speed, for which purpose constant running has to be provided for and overheating liberally guarded against; but reversibility by controllers of large size is necessary, and the motors must be capable of large initial torque and of being run dead slow and at varying speeds for long periods, as in channels, or during fogs, whilst the windings and resistances must not get too hot. Altogether, the designers' task is especially onerous, and the fluctuations of voltage due to starting the main motors from a generator with no reserve power, and the varying amperage, due to drop of voltage at starting, would be most severe upon the equipment. In marine turbines the incoming steam neutralises the "thrust" on the propeller shafting; but motor-driven shafts would be subject to the large friction from this cause. Finally, sea-going electricians of a high degree of expertness would be necessary.

Taking the first and "most serious objection," the writer presumably means that not only the cables, but also the generators and motors are liable to breakdown, owing to the insulation being destroyed by dampness. All the electrical portions of the plant are very low in the ship, far removed from the outside atmosphere, and the air is quite the warmest and driest of any part of the vessel, and there is not the slightest reason for any deterioration in the insulation, which, as a matter of fact, would probably improve. The very large motors employed in mines for winding and other machinery, and rolling-mill motors for steel works and factories, operate under conditions far more severe than would the dynamos and motors placed in well protected positions in the depths of a ship. That there is not the least danger may be inferred from the fact that trouble is never experienced with the large dynamos now used on ships for lighting and power, and it is a fact for which the present writer can vouch, that in the case of the *Mauretania* the insulation resistance of the dynamos increased considerably after some months' service. The higher voltage which would be used for turbo-electric propulsion does not alter the question, since the insulation in the first instance would be relatively stronger, and since 220 volts is now the common working pressure on battleships, the increase to 500 or even 1,000 volts with electric propulsion is not a very big change. Indeed, we may regard as an indication that the danger to insulation at sea is being recognised as a fallacy, the fact that the Admiralty has been gradually raising the voltage of electrical supply on warships, and there are several firms who would be perfectly willing to guarantee to maintain a 3,000-volt turbo-electric system for an indefinite period without a single breakdown in insulation.

The next interesting point raised is the trouble which would ensue if water entered the engine room. The writer here shows a lamentable lack of knowledge regarding sea-going conditions. If he implies that the whole engine room and stokeholds become full of water, nobody will deny the statement that "serious results must follow," but it is difficult to see how there would be any difference in the two cases. In the event of this *very* improbable contingency, everything would be at a standstill, and neither electrical nor mechanical machinery would be capable of driving the ship if the plant were totally submerged. If, however, the engine room became partially filled with water, the electrically-propelled ship would be better off than the direct driven, since the castings are smaller and lighter, and the turbines and generators would be placed considerably higher in the former case. But the point has evidently been forgotten that all modern ships are divided into watertight compartments, and the effect of one compartment being filled is not very disastrous, since it can be at once isolated by closing the doors and the water pumped out. The great advantage of electric propulsion, if this should happen, is easily demonstrated. Consider a ship with two engine rooms, one of which becomes full of water. With the electrical system the remaining generator would continue to run and supply *both* the motors driving the propeller shafts, so that the boat need not stop, but if the ship was direct driven, it would certainly be inadvisable to run with only one propeller, as would be necessary.

It is next stated that there is little hope of coping with an electrical breakdown—a remark which is somewhat difficult to follow. Unless the plant had been totally submerged, the repairs necessitated by the influx of water would be quite insignificant, and with regard to general reliability, electric propulsion has much in its favour. All the ordinary accidents to which electrical machinery is liable are much more easily overcome than those of steam engines and turbines. If a turbine strips at sea, if a piston engine cylinder cover is forced out, if a connecting rod breaks, its repair is seldom attempted; but if an armature coil burns out, or even if a short occurs, the fault is soon located, and a few comparatively unskilled men can put matters right in a very short time. Besides, it must be remembered that serious accidents rarely happen to electrical machinery, as it can be so much more efficiently protected than steam plant with fuses, circuit-breakers, and other safety devices. It may be said that there is still the danger of breakdown of the steam turbine with turbo-electric drive, but this, curiously enough, is not so great as with the direct drive. Blade stripping at high speed is much less likely, owing to the very much smaller cylinder castings (due to the higher speed and the smaller power required), which consequently minimises the risk of distortion. Moreover, there are no astern turbines, where the greatest possibility of stripping often occurs, as exemplified by the *Mauretania*.

With regard to the design of the main motors, the writer is wrong on practically every point he raises. Certainly it is interesting to be told that overheating is to be guarded against. Is this a new or insuperable difficulty in the design of motors and generators? Probably he is under the impression that direct current will be used for electric propulsion, but this, of course, is not likely. The controllers for reversing will be very small instead of very large, since it is only necessary to have a simple switch to reverse the phases either in the motor or generator, as explained in a previous article. (See ELECTRICAL REVIEW, July 23rd and 30th, 1909.) The motors need not have a very large starting torque—a ship is not like a tube train requiring to reach full speed in 30 seconds—but by means of the simple switchgear they can be stopped and reversed in a few seconds. They must admittedly be capable of running dead slow and at variable speeds for long periods, and this is just where electric propulsion has an enormous advantage over the direct drive. As was shown in a previous article, in the electrical system the motors run at quarter, half, three-quarter or full speed at practically the same efficiency, whereas in the case of the *Lusitania*, the steam consumption at 15 knots was 40 per cent. greater than at 25 knots.

The extent to which the writer understands the problem is suggested by his statement that the windings and resistances must not get too hot. It is, perhaps, sufficient to say that there are no main resistances, and hence the likelihood of their becoming too hot is rather small; all the regulation is, of course, carried out by a transformer arrangement.

We further read that the generators have no reserve power, which may be needed when the motors start—a wild remark which betrays complete ignorance of one of the most characteristic properties of turbines. Even if the motors required more than full power when they started up—which they do not—turbo-alternators, as is well known, can easily take 30 to 50 per cent. overload without appreciable drop of voltage. The machines at Lot's Road, designed for 6,000 KW., often run at 9,000 KW. for some time, while those at Carville (nominally 4,000 KW.) develop 7,000 KW. for an hour, and exactly the same type would be adopted at sea. The idea, therefore, of a highly improbable overload being severe on the machinery is somewhat amusing.

The question of the thrust on the propeller shaft is unworthy of discussion, since motor-driven shafts are in exactly the same position as those driven by reciprocating engines. Apparently the writer has never heard of the propeller thrust block.

The last sentence is pathetic, and perhaps explains this strenuous opposition. "Sea-going electricians of a high degree of expertness would be necessary." Why not? Are there not enough of them?

Tungsten Lamp Patents.—According to the *Electrical World*, the General Electric Co., U.S.A., which already owns the Just & Kusel patents, has now purchased all the American patent rights covering the tungsten lamps of the Bergmann Electric Works, Berlin, for the next ten years.

MUNICIPAL TRAMWAYS ASSOCIATION.

The Central Repair Depôt of the L.C.C. Tramways.

Abstract of paper by W. E. Ireland, *Rolling Stock Superintendent.*

This depôt is situated on a site close to the River Thames at East Greenwich, some 6·9 acres in extent, and adjoining the Angerstein Wharf branch of the S.E. and C. Railway, from which it is proposed to construct a siding leading into the depôt.

Fig. 1 shows the general plan arrangement of the buildings which will comprise the completed depôt, whilst fig. 2 shows a cross-section. The portion within the hatched lines covering 3·25 acres, is practically finished and has been in use some months, this consists of smiths', machine, wheel, truck overhauling, inspection, body and paint shops, and tool, finished part and general stores on the ground floor, with electrical repair, plough, tool, light machine and pattern shops on the galleries.

The buildings were designed and erected under the supervision of Mr. W. E. Riley, the Council's superintending architect, and have a capacity for dealing with the overhaul of 600 cars per annum; they are arranged on a definite scheme for dealing expeditiously with the cars during the two weeks each has to be in the shops for its annual overhaul and renovation.

The Metropolitan Police Regulations require the body work and painting of each car to be thoroughly renovated once in every 12 months. Advantage is therefore taken of this regulation to systematically overhaul and put into first-class condition the whole of the mechanical and electrical equipments of the cars. The layout of the depôt is arranged so that regular and synchronous progression of the work in the several shops is ensured.

The works superintendent issues forms, which are forwarded to the rolling stock superintendent, requesting the cars becoming due for renovation in any one week to be transferred from the several car-sheds from which they operate in service, to the repair depôt on the Sunday night; each car after entering, sheds its plough by means of a special run-out arrangement. A small steam locomotive then draws the car into the depôt through the porch-like entrance and on to a specially constructed shallow traverser, by means of which it is taken into the inspection shop. Here on the following morning an inspector carefully examines the car, noting the repairs required, and compiles a detailed list of the necessary work for the information of the superintendent. While the car is in the inspection shop the brake rigging and other parts of the trucks and equipments are disconnected, and bearing caps and bottom halves of the gear cases taken down ready for dismantling. The car is again drawn on to the traverser, a pneumatic jack placed under each side of both headstocks and the body lifted clear of the trucks. The traverser is then moved along the pit, carrying the trucks from beneath the body to a point immediately under one of the lighting wells provided in the floor of the gallery above. Here the motors are lifted by an electric travelling crane running on a gantry above the gallery to the motor overhauling shop, and the trucks sent into the truck shop on the western side of the traverser pit. The body is then placed upon a temporary truck and taken into the body shop for the attention of body makers and wiremen. The work required on the trucks, motors and bodies usually takes about four days to complete, at the end of which time the whole car is reassembled ready for the paint shop.

The paint shop is cleared of its finished cars every Sunday and the overhauled and reassembled cars placed in readiness for the painters to start their part of the work the first thing on the following morning. The painting and varnishing occupies a week, it being a rule that each week's output of renovated cars is ready for inspection by noon on the second Saturday following the day upon which they were received at the depôt.

The foregoing gives a general idea of the routine as formulated, but owing to the fact that the depôt is not yet in a finished state, it will be evident that some minor departures from the strict observance of this routine are inevitable.

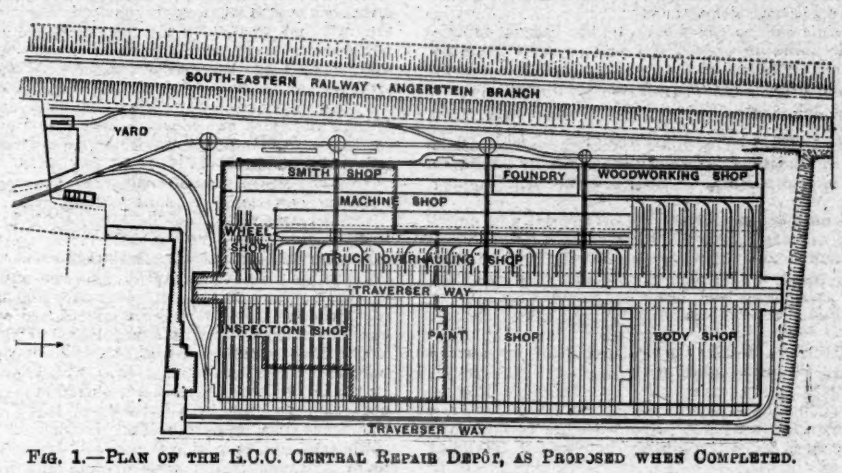


Fig. 1.—Plan of the L.C.C. Central Repair Depôt, as Proposed when Completed.

The smiths' shop contains 14 down-draught hearths, two 5-cwt. motor-driven pneumatic power hammers, one Ryder forging machine, one drop hammer with ½ ton tup, one forging and annealing furnace, one double-head emery grinder, one punching and shearing machine, a 60 in. exhauster and 17½ in. blast fan.

Stoneware ducts 30-in. dia. are laid in the ground and provided with suitable branches brought to the floor level for connecting with the draught pipe of the hearths. These ducts terminate in a square brick chamber at the southern end of the shop into which a 60-in. exhauster is built. This arrangement not only provides for the efficient extraction of the smoke, dust and fumes, but also ensures very satisfactory ventilation throughout the shop.

The blast pipe is also composed of stoneware ducts laid alongside the exhaust mains under the floor, with branches brought to the floor level. That this method of dealing with a smiths' shop has proved satisfactory will be readily appreciated from an inspection of the shop, for although work has been in progress at practically all the fires continuously since June, 1908, the walls are almost as free from dust and dirt as when the shop was first opened.

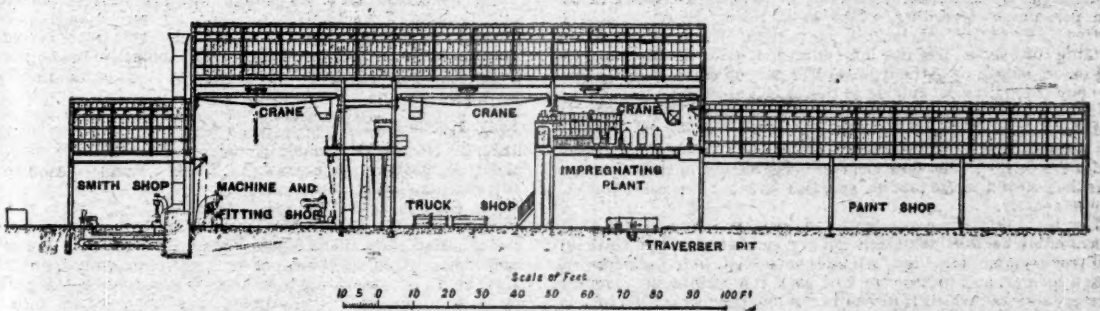


Fig. 2.—Cross-section Through the L.C.C. Repair Depôt.

The hearths and anvils are set at an angle in relation to the longitudinal centre line of the shop, thus enabling the maximum length of bar to be handled at each without incommoding the work in progress at the next fire.

The wheel shop is equipped with three high-speed tire turning lathes, three tire boring mills, one 150-ton power wheel press, one wheel boring machine, one 4-hole gas tire heating hearth with jib crane and pneumatic hoist, and half-a-dozen jig saws for cutting off tires. The tire-turning lathes are motor-driven and capable of taking the heaviest cut on high carbon-steel tires that modern high-speed steel will withstand.

The cutting power of these machines was calculated upon turning at the rate of 50 ft. per minute; up to the present time it has not been found possible to get above 30 ft. per minute cutting speed on tires of from ·60 to ·68 carbon, skin hardened by months of constant rolling on the track.

One of the most important points to consider when specifying for

or designing a machine for turning high tensile tires is the rigidity of the machine. Both tramway engineers and machine-tool makers appear to have treated this point too lightly in the earlier types of lathes, with the result that the work took far too long to do, and owing to the vibration set up in the machine, only light cuts could be taken even with high-speed steel tools. Tests have been made in the Council's shops on both types of machines, and it has been noted that the tools failed much sooner with a light cut on a machine which "chattered" than with a heavy cut on a rigid machine, and whereas, in the earlier type of lathe, from eight to ten hours were required to re-turn a pair of tires, or an average of six pairs per week of 54 hours, with the machines now in use the average output of each machine is six pairs per day or 34 pairs per week of 54 hours.

The life of steel tires made to the Council's specifications averages 56,000 miles for pony wheels and 50,000 for driving wheels. This gives an average rate of wear per $\frac{1}{8}$ in. radial reduction of thickness of 5,090 miles and 4,545 miles respectively.

The tire-boring mills were specially built to the Council's specification; pneumatic hoists are carried on jib cranes above the mills for lifting the tires on to and off the machines. At the present time some 430 new tires and 575 pairs of wheels complete are handled in this shop per month, or an average of 5,160 and 6,900 respectively per year.

The machine shop is equipped with a 3-ton three-motor electric crane running the full length of the shop; a number of lathes, by well-known makers, also milling, drilling, screwing and tapping machines.

The space at the northern end is occupied temporarily by an oil and waste-saving plant consisting of two turbo-centrifugal machines, one rotary washer and two oil filters by the Oil and Waste Saving Co. This useful plant is capable of dealing with all the wool waste from axle boxes and bearings, in addition to the ordinary cotton waste and wipers used at the car-sheds and works.

The plant is designed to handle about 20,000 lb. of wool waste and reclaim some 12,000 gallons of oil per year, and it is estimated that the saving due to this alone will be in the neighbourhood of £600 to £700 per annum, exclusive of the cost of labour involved in handling the material, which, together with the cost of soap powders, steam, power, &c., will probably not exceed £150 per annum.

The centre of the shop between the machines is occupied by fitters' benches, equipped with the usual parallel quick action vices and also a marking off table. The line shafting is driven by five 36-H.P. polyphase motors, each attached to the upright stanchions. The shafting is divided into five sections, coupled by means of claw couplings, so that any section may, if necessary, be run independently of the others. Several of the machine tools in this shop have been built to the Council's specifications, and are adapted for work of a special character.

The power hack saws, special vertical milling machine and four-spindle drilling and tapping machine form the main part of a special plant for machining magnetic brake shoes, of which a very large number are used. The material for making these shoes is obtained in the bar direct from the rolling mills, and is cut into lengths by the power hack saws; after cutting to correct length the bars are placed in a jig on the milling machine table, which will accommodate 48 shoes. The cutter is of special form to the author's design, and carries 14 high-speed steel tools for roughing and two tools for finishing. The diameter of the cutter determines the width of the register cut in the shoe, and the depth of the cut averages $\frac{1}{16}$ in. The rate of feed of the table varies from 2 in. to 4 in. per minute according to the size of the cutter used, and the cutting speed of the tools is 70 ft. per minute. This machine when working on shoes for the largest magnet will machine a gap $18\frac{3}{4}$ in. in length by $\frac{7}{16}$ in. deep at the rate of 60 shoes per hour. The power required for cutting at this rate is about 25 H.P.

In each shoe two $\frac{3}{4}$-in. holes require to be drilled and tapped, and the four-spindle machine was designed to deal with this work; the shoe, carried in a jig which slides along the table, is first set under the drill spindles and the two holes drilled simultaneously; it is then moved to the tapping spindles and the two holes tapped simultaneously.

The tool, finished part, shop, and general stores are located immediately beneath the small gallery and between the machine and truck overhauling shops. All tools are served out to the workmen over a counter, and to keep track of each the recipient is required to sign a ticket, which is placed in the bin from which the tool is taken. The shop store is used for parts in course of progress through the shops.

The general store, which contains a 20-ton weighbridge and some 7,000 steel bins, is used for the storage and distribution of such parts as are usually obtained from outside manufacturers, and stands in relation to the shops generally as does an outside supplier to a manufacturing works, this part of the organisation being under the supervision of the superintendent of the tramways stores.

The truck shop is equipped with two 5-ton three-motor electric cranes, and the usual fitters' benches, vices, pneumatic drills, hammers, chippers, &c. There are 14 working tracks, each capable of accommodating four bogie trucks or three single four-wheeled trucks. A narrow gauge industrial railway track runs along the full length of the shop on the side adjacent to the stores, with branch lines between alternate pairs of truck tracks. Two small battery-power motor-driven service wagons are in course of construction for the purpose of transferring material from or to the stores and other parts of the depôt and the men employed on truck overhauling. Pneumatic lifting jacks made to the author's design are installed in this shop for lifting the bodies off their trucks.

In this shop the trucks are first taken in hand for cleaning, after which all bolts, pins, links, brake rods, &c., are taken off, examined, and those which have worn are either scrapped or repaired, and replaced by new or replaced after repairing. The end and centre sills are taken off and the trucks squared up by trammelling diagonally across from centre to centre of the horn blocks. It has frequently been found necessary with the early types of trucks to either lengthen or shorten one of the side frames to bring the truck square.

All brake gear parts are thoroughly annealed, screwed parts are cut off and new ends welded on and screwed, the holes in the jaws of adjusting rods, links, &c., are closed in the smiths' shop and opened out to correct size by redrilling for the pins. The brake shoe holders, brake beams and shoes are removed and worn parts made good. The chains are removed and each link carefully examined, all faulty ones removed and replaced by new, and the whole chain carefully annealed before being put back on the truck. Axle boxes are thoroughly cleaned, the wool waste and oil removed and treated in the plant referred to elsewhere. Axle box bearings are removed and replaced with new ones where necessary, whilst those bearings which have a longer life are replaced after the sides have been eased in the machine shop. All springs are removed, corrected for size and retempered when necessary. Wheels and axles are removed, and the tires either returned or renewed as is found to be necessary; gear wheels are examined and renewed as required.

The Council's method of dealing with the gear wheel and pinion problem gives excellent results in practice.

Case-hardened steel pinions have been in use since 1906, and are now standardised. They were first tried on the single-deck steel cars when the Kingsway subway was opened for service in 1906. The pinions then fitted are still in service, and the average mileage of the 32 pinions on these cars is to date slightly over 110,000 miles each, whereas the average life of unhardened pinions working under exactly similar conditions is from 19,000 to 20,000 miles each.

The life of ordinary cast-steel gear wheels meshing with the case-hardened pinions is also improved. This is probably accounted for by the fact that the hardened teeth retain their correct shape for a much longer period than unhardened teeth, with the result that they transmit a uniform rolling motion instead of the combined rolling and sliding motion transmitted by partly worn teeth, which naturally causes greater wear of both pinion and gear teeth in a given time.

The steel has the following analysis:—Carbon, ·15 per cent.; silicon, ·02 per cent.; sulphur, ·05 per cent.; phosphorus, ·05 per cent. The pinions are specified to be case-hardened to a depth of not less than $\frac{1}{16}$ in. from the surface of the teeth, the centre being left soft.

A lubrication mixture which gives excellent results is composed of black axle oil and sawdust mixed in the proportion of 42 gallons of oil to 216 lb. of sawdust, the cost of which works out at approximately 4s. 8½d. per cwt. The mixture is liberally applied and found to quieten noisy gears to a remarkable extent, in addition to providing an efficient lubricant for the teeth.

The traverser pit occupies a central position in, and extends the full length of, the building; the track rails are laid to 13 ft. 6 in. gauge with standard L.C.C. conduit work in the centre.

When the second or exterior traverser pit is constructed, it is proposed to lay a pair of rails on each side of the centre conduit at 4ft. 8½ in. gauge and make use of this as a track for testing the cars, each of which will be run and the brakes and equipment tested before being sent to the car-sheds for service.

The inspection shop, situated at the south-eastern end of the building, has 15 tracks with pits, and the gangways between the pits are 1 ft. $1\frac{3}{4}$ in below the rail level. This shop is equipped with hydraulic pit jacks, and a system of compressed air pipes with cocks at frequent intervals for connecting to pneumatic drills and other portable tools.

The painting shop has eight tracks each capable of accommodating three cars. Between each pair of tracks H section columns are fixed, provided with movable wrought-iron brackets for supporting planks on which the painters stand. These brackets have vertical adjustments at 24 in. intervals.

The shop is heated and maintained at a temperature of 60° F. when the outside temperature is at 30° F., by means of nine small steam heated units of the Stanlock system. Each unit is capable of condensing 100 lb. of steam per hour, and circulating from 2,000 to 2,200 cb. ft. of warm air per minute, the circulation being effected by a small motor or belt-driven fan attached to each unit. Eighteen similar units are disposed in the several shops where heating is required.

A small gallery is located immediately above the stores and between the machine and truck shops, a temporary pattern-makers' shop, tool shop, and a number of light machines are located on this floor. One 20-H.P. polyphase motor with auto-starter operates all the tools on this gallery.

The large gallery, located above the traverser pit, is served by a 3-ton three-motor electric travelling crane.

The southern end of the gallery is occupied by the test room; here all re-wound and repaired armatures are placed in testing frames and run on load in both directions, the artificial load being absorbed by a Froude water dynamometer. Brake magnet and field coils are tested for continuity, internal short circuits and ohmic and insulation resistance, before being replaced on the cars after overhaul, and all repaired and new ploughs pass under the inspection of the test room attendant before being despatched to the car-sheds for use on the cars.

The method of testing field and brake magnet coils for internal short circuits presents some points of interest, and in view of its simplicity is perhaps worthy of description. A frame of Swedish

transformer iron which is shown by fig. 3 has a hinged yoke across the top which is counter-balanced as shown and made to lift clear of the front limb of the frame.

The back limb carries a permanent coil which is excited from one phase of the A.C. supply and forms the primary coil of the transformer. The coil to be tested is placed on the front limb and the hinged yoke dropped into position. Just above the transformer is a panel containing the ammeter which indicates the current flowing in the circuit. If the coil to be tested has no short circuit the

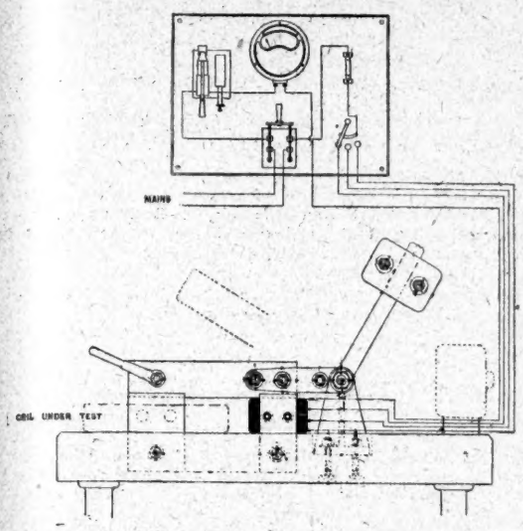


Fig. 3.—Testing Transformer for Magnet Coils.

current flowing in the primary circuit will be so small as to be scarcely readable on the ammeter; if, however, there is a short circuit in the coil, even if but one turn, an appreciable current will flow and be indicated by the ammeter.

With the exception of the space at the northern end of this gallery floor, occupied by the office block and the advertisement plate stove, the remainder of the gallery is used as an electrical repair shop. Here the following plant is installed: two commutator

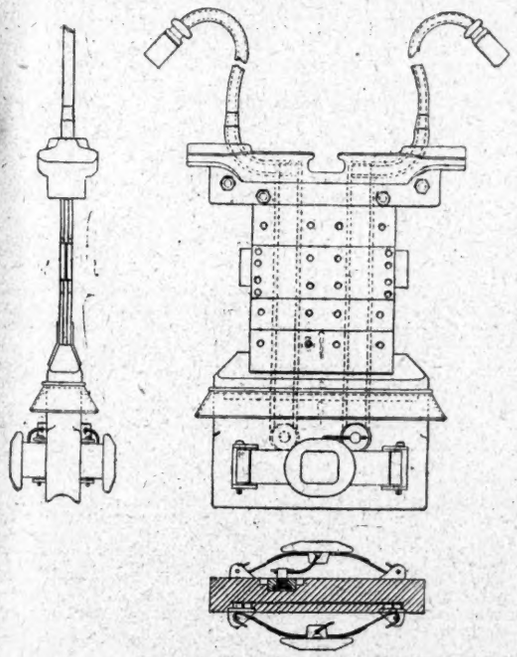


Fig. 4.—Standard L.C.C. Plough.

turning and grinding lathes, two armature banding lathes, and six coil-winding machines. Here all ploughs, motors, armatures, controllers, field and brake magnet coils are dealt with.

The commutator grinding and turning lathes have in practice shown distinct advantages over the usual method of simply turning the commutators and finishing off with glass paper.

A plant is installed for vacuum drying and impregnating armatures, field and brake magnet coils, &c.

All the ploughs required for operating the cars on the conduit system are made and repaired at the depôt. There are two types of plough in use, one of which is made with a solid hard rubber base and the other is made with a built-up wood base, in both cases the fittings are similar and interchangeable one with another. A full set of jigs and press tools have been made in the tool shop for the rapid and economical production of the detail parts.

The steel frames for the rubber base ploughs are made and bolted together on a jig and sent to the rubber works for the bases to be moulded on, and to ensure accuracy of position of the base of the frame, the rubber makers' moulds are fitted with locating blocks which match those on the frame erecting jig. The steel frames for the wooden base ploughs are precisely similar to those for the rubber ploughs. The wood base is, however, made up and bolted on in the depôt.

Fig. 4 shows the general arrangement of the latest type of rubber base plough in use. The collector shoes are of cast-iron, and fastened to a spring by a wedge. These shoes have an average life of 8,000 miles and cost about 3½d. per pair. The friction plates are of steel, have an average life of 3,000 miles and cost about 9s. per 100, which includes the cost of labour in producing them. This works out at 1s. 10d. per 100.

The total maintenance cost of ploughs, including all renewals during the last financial year, was ·05d. per car-mile. A new rubber base plough costs about 107s.

The depôt is lighted throughout, both inside and outside, with the exception of the paint and inspection shops, and the offices, by 60 Sunrae flame arc lamps by Davy, arranged in series of 10 on the 500-volt D.C. supply.

The power supply is by three-phase H.T. 6,600-volt current supplied direct from the generating station at Greenwich to the transformer room which is situated outside the depôt.

The H.T. current is controlled by means of a H.T. automatic oil switch with an overload time limit relay.

Four 150-KW. single-phase transformers of the Berry type, one of which is a spare, have been installed; these transform the pressure from 6,600 volts to 220 volts.

A switchboard by Spagnoletti has been installed for controlling the H.T. and L.T. alternating current, and the D.C. supply.

Each feeder panel carries two feeders, one of which has in each case been provided to meet the demand in the extensions, additional spaces having been left for further panels to be erected when required. The feeders from the panels are led in underground ducts to various sections of the depôt, where they are connected to fuse distribution boxes, from which each motor circuit is taken.

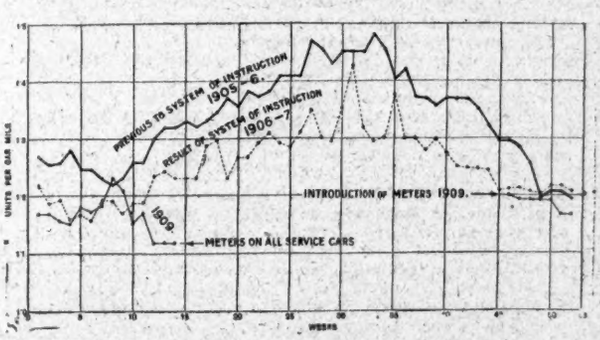
All feeders are of the three-core paper-insulated lead-covered type, the cables for the small ventilating fan motors are of the three-core V.I.R type.

The installation of the electric lighting, power supply and telephones has been supervised by Mr. J. H. Rider, tramways electrical engineer.

Current Consumption.

A paper on this subject was submitted by Mr. R. S. Pilcher, of Aberdeen; the matter was fully dealt with by him in an earlier paper read before the Scottish Tramway Officials' Association, of which a lengthy report appeared in our issue of August 20th, page 292.

That good results may be obtained by careful instruction of the motormen and the installation of some type of meter, is evidenced by



Current Consumption Curves, Aberdeen Tramways.

the current consumption curves relating to Aberdeen, which we reproduce herewith.

The author mentions that all the service cars on the Aberdeen system are fitted with ampere-hour meters, and (as shown by the curve) the current consumption is lower than it has been for the last five years, despite heavier cars. He believes that the actual type of meter employed matters little, as it is the comparison, day by day, with other cars on the same route, which is of value.

Some Comparisons of Continental and British Methods of Operating Tramways.

(Abstract of paper by A. R. Fearnley, *General Manager, Sheffield Corporation Tramways.)*

I think it will be agreed that the differences which at once impress one when inspecting Continental tramway systems are:—

The rigid adherence to the single-deck type of car.

The carrying of a large number of standing passengers, especially on the front and rear platforms.

The almost universal use of trailer cars.
The large and increasing number of vestibule cars (both motor and trailer cars).
The bow collector which is used in place of the trolley boom.
The provision of shelters or waiting rooms at important centres and junctions.

A further difference is now being introduced, viz.:—The provision of railless electric traction systems for developing ultra-suburban traffic, such as is catered for at present in this country only by the horse or petrol 'bus or by railways, until the population warrants laying down tramway track.

The most frequent objection that I heard or have seen to the use of double-deck cars on the Continent is that a great deal of time is lost in passengers entering and leaving the cars at the stopping stations, to which statement I anticipate few British managers will attach much importance. The most serious objection I heard advanced was one referring to the continued and lengthy absence of the attendant from the platform.

The best suggestions that I heard in favour of the single decker were that it can be readily coupled to a trailer and worked in this way without danger and inconvenience, and, what is equally important, the only additional attendant required may be a shedman or other employé of the department, not necessarily a regular traffic employé, the brakes being either magnetically or air controlled on both cars by the motorman, and these appear to be the most favourable arguments that may be advanced for its adoption in the first instance. In Sheffield the average current consumption per car-mile by the double-deck cars on our most hilly route is 1·64 units per car-mile, and on our most hilly single-deck car route 1·46 units per car-mile.

Another interesting comparison is in the mileage obtained from tires. The average taken from the double-deck cars under certain conditions is 4,505 miles per ⅛-in. wear, and for the single-deck cars under similar conditions 4,576 miles per ⅛-in. wear, or only 70 miles per ⅛-in. wear in favour of the single deck, with 46 per cent. less carrying capacity.

On comparing the life obtained from brake shoes, we find that:—

Double-deck	covered-top cars	average	4,520	miles per set of shoes.
„	open-top „	„	4,643	„ „
Single deck	„	„	4,530	„ „

Note.—Single-deck cars are worked on three routes, two of which have severe gradients; the third route is practically level.

The traffic wages are the same, except in cleaning, where there is certainly a little in favour of the single deck.

Other important arguments in favour of the double-deck car, without repeating many well-known points, are:—

Small quantity of rolling stock required.

Considerably less car-shed accommodation necessary. (Vienna, with a population of barely 2,000,000, has over 2,000 cars.)

Comfortable and very popular accommodation for smokers in all sorts of weather.

Judging by the way in which they are generally used, a trailer appears to mean additional accommodation for about 28 more passengers with each motor car. There are the increased wages and maintenance charges and the greater street area covered, together with the necessity for providing double track where the trailers are in use, also the extra current consumption (the Continental trailer appears to vary in weight from three to six tons), and the difficulty in placing depôts in suitable positions to avoid a large amount of lost mileage in taking the trailer on and off.

It is interesting to note that the use of the vestibule type of car is very general, and is rapidly on the increase on Continental tramway systems. In some cities it was probably provided in the first instance for the protection of the passengers riding on the platforms, and it now appears to be the exception for large Continental tramways not to have a considerable proportion of their cars provided with vestibules.

In 1907 I had the opportunity of experimenting with a bow collector which was manufactured by Messrs. Brecknell, Munro and Rogers, Ltd., for a Russian tramway, and whilst, of course, our overhead line had not been constructed for a collector of this type, we found that there would have been little difficulty in obtaining very satisfactory results with this arrangement if the overhead line had been suitable. I am of the opinion that the trolley boom, with its attendant overhead fittings, is the most unmechanical feature of the whole of our tramway equipment, and despite all that can be done in the way of perfecting our overhead work by keeping the line over the track, planting extra poles and fixing extra pull-offs to ease the curves and by regular and systematic examination of trolley standards, trolley heads and overhead fittings, there is still a big weakness in this attachment.

The cost of trolley upkeep in Sheffield for our last financial year amounted to £1,031 14s., or ·0336d. per car-mile. The cost on a line where the bow collector is in use was given to me as being ·041d. per car-mile, and, in my opinion, the bow collector would be a considerable advantage if it could be worked with such a small difference in cost.

In meeting the requirements of suburban districts lying beyond the point to which it is considered financially safe to construct tramway tracks, reports show that there are very considerable possibilities in the rail-less electric trolley car, and in my opinion, if it is given a fair trial without unnecessary restrictions and red flag regulations, it will, within the next few years, form an important addition to our tramway business.

In comparing this method of dealing with suburban traffic, I would say that I think it is superior to any system of horse, steam, electric, or petrol 'bus, which, so far as my knowledge extends, is at work in this country at the present time.

Some considerable time has now elapsed since the reports of the deputations regarding the feasibility of adopting the railless electric cars were made, and as yet no corporation has obtained the necessary powers to work such a system, but it is anticipated that at least two of our large cities (Leeds and Sheffield) will obtain these powers within the next 12 months.

Technical data concerning Electric Hub-Motors as in use on the Vienna Municipal Trackless Trolley System.—The electro-motor of the trackless trolley vehicle gives about 20 H.P. The field magnet is mounted on the axle, and resembles an internal pole star. The armature is placed outside, and forms a part of the wheel itself in such way that it revolves as a wheel around the pole star. The field magnet has ten poles. Each spool is wound in a patented way, and consists of a flat copper band of uniform section, but of variable width and depth. The armature consists of a great number of spools built into the frame of the wheel.

The collector is arranged in a vertical plane so that the vibration of the car cannot lift the brushes, which are fitted with special carbons.

The motors are placed in the back wheels for the trackless trolley system, but on lines of heavy gradient four motor wheels are employed—two at the back and two at the front—in which case the front wheels are fitted with a special device securing perfect steering even in the case of a sudden breakdown of one of the front wheel motors.

ELECTRICAL STEEL.

There is no doubt that the spread of electro-metallurgical processes has received an enormous impulse in recent years from the wide extension of cheap electric power supply. When we have in our own country such large power systems as that of the Newcastle-upon-Tyne Electric Supply Co., Ltd., and other lands are favoured by such enormous water-power sources as the falls of Niagara and Shawinigan, to say nothing of the Scandinavian possibilities, there is no wonder that electric power is being applied to processes which were formerly considered to be the most remote from electrical engineering.

A notable case in point is the production of electric steel. At the present time some 67,000 H.P. is employed in America and Europe for the production by electricity of steel and its alloys, and the refining of low-grade steel and pig-iron. The use of electricity in metallurgical processes has in many cases resulted in the creation of industries in districts previously considered unsuitable. Wherever it is possible to obtain electricity cheaply, either from water power, steam-driven stations, or producer gas plants, it is feasible to put down an electric furnace.

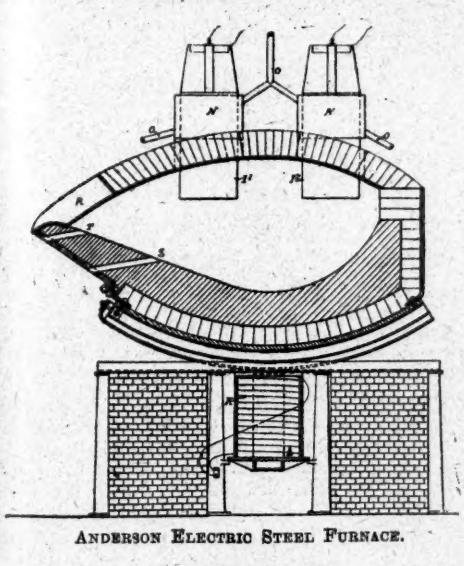
If we assume that electricity can be produced at the rate of 40s. per electrical horse-power per year of 8,760 hours, it is found that by the latest processes of electric steel production one ton of steel-making pig-iron can be obtained at a cost of £1 15s. 6d., exclusive of the price of raw material. This figure is based on the cost of labour, repairs and maintenance, together with an average price of £1 5s. per ton of product for lime, electrodes, coke and electrical energy, and is the result of a 90-ton working test on a process which we are about to describe.

The high temperature at which the electric furnace works ensures almost complete freedom from phosphorus and sulphur in the iron, and assists considerably in the complete amalgamation, purification and deoxidation of the steel produced. Hence this is equal to the best crucible steel, and can be manufactured with traces only of silicon and manganese. Moreover, the precision with which carbon and metallic alloys may be added to the electric furnace renders it possible to produce steel of any desired grade and composition, ranging from tool steel to mild constructional steel. Added to this is the fact that occlusion of gases in the metal does not occur, and a product is therefore obtained which is free from blow-holes, uniform in composition as ascertained from analyses of drillings from different parts of ingots, and capable of being forged with great ease. By electrical processes practically pure iron has been produced, analysis showing 99·95 per cent. of true iron. Mr. Harbord, late Metallurgist to His Majesty's Indian Government, has concluded a report on the production of electric steel by saying:—"As a result of my investigations into the metallurgy of the electrical production of steel and the electrical smelting of pig-iron, I have come to the following conclusion:—Steel, equal in all respects to the best high-class Sheffield crucible steel, can be produced in an electric furnace at a cost considerably less than the cost of producing a high-class crucible steel."

Probably the most important application of the electric furnace, so far as existing steel works are concerned, is the electrical purification of low-grade steel and pig-iron, as by this means steel can be produced to any specification. When dealing with pig-iron, the metal in its molten condition is charged direct into an electrical furnace. It is here covered with an oxidising slag, which is removed after about 30 minutes. A layer of carbon is then placed on the liquid metal, and over this a slag free from oxygen. The neutral slag so far cools the mass that the greater part of the ferrous-oxide is reduced by the carbon. Certain quantities of manganese ore are added to the neutral slag, and this destroys any remaining ferrous-oxide. When the mass is perfectly white a carbon test is made. A carefully calculated mixture of iron and carbon is then introduced into the furnace, and when this is dissolved the necessary alloys are added to obtain the grade of steel

required and the whole of the contents are drawn off. Where it is required to refine a low quality steel, this is first melted in a Martin or other furnace and then transferred while still molten to the refining furnace, built on a lower level than the first. A charge can be completely finished in 75 minutes. In some instances 60 minutes suffice, whilst for special steels the charge may remain in the furnace for as long as 1¾ hours. Allowing that a 5-ton furnace would require, say, 800 H.P., equal to an average energy consumption per ton of special steel of 280 H.P.-hours, the cost of energy for the process cannot be considered excessive.

The furnace which Mr. T. Scott Anderson, of Sheffield, has designed and patented for the above and similar processes is shown in section below. It consists of a chamber somewhat of the shape of the porcelain boiling dishes known to chemists, with a domed cover, an aperture being left at the spout for pouring purposes. It is constructed of highly refractory materials, and is mounted either on trunnions or rockers, as shown in the illustration, for the purpose of pouring. In addition to the main pouring lip for use when full, tapping holes are provided, so that when the metal is at the lowest point in the furnace hearth it can be run off. Tapping is preferable to pouring at this stage, as



Anderson Electric Steel Furnace.

it is not uncommon to find that pouring from so low a point causes a distinct change in the quality of the steel, even though both metal and slag may be quiescent prior to pouring. Through the covers of the furnace are admitted substantial electrodes capable of vertical adjustment, arranged in parallel or series according to the work for which the furnace is designed. Both the furnace and the electrodes are fitted with a continuous water-jacketing system, and directly beneath the base of the furnace, in line with each electrode, are fixed electromagnets which counteract any interference with the formation of the arc and control its action while at work. Moreover, the furnace is so constructed that the concentration of the incandescent gases around the electrode is utilised to the best advantage, and the arrangement tends to efficiency in a very marked degree.

Another sphere in which this furnace is found to be of considerable advantage is in the production of steel from scrap steel and iron. In railways, dockyards and engineering works the problem of effectually and profitably dealing with the large amount of old and waste material is a weighty one, and any process which can show a return in tool steel, ingots for castings, and the like, has a certain hold on the market. A similar furnace to the one above described is used, the charge being placed in it cold, and a little ore and lime is added. When the furnace has been charged, current is switched on and the material reduced to a molten state by a combined process of arc and resistance heating. A slag formed by the lime and silicates of the ore floats on the surface of the molten metal; the electrodes dip just beneath this slag, but not into the metal. An air blast is then introduced, and the impurities in the charge becoming oxidised, enter the slag, which is then withdrawn. One or two new slags are introduced, and the process proceeds in this way, with the result that a very pure product is obtained. When this point is reached the requisite alloys are added and the charge is tapped. The current is kept on the furnace for about six hours, and the average energy consumption is about 1,000 H.P.-hours per ton of steel produced. Assuming the cost of scrap at about £3 per ton, the cost of labour of four men at £1 4s., and the cost of electrical energy at 8s. 6d. per ton of metal produced, and making allowances for electrodes, repairs and renewals, interest and depreciation, alloys, ore, lime, &c., the cost of steel making from scrap works out at about £6 8s. 6d. per ton—a figure taken from actual working. In this case the electrical energy required was generated from coal costing 25s. per ton, using gas engines and gas-producer plant. An installation capable of producing 900 tons of steel per annum from scrap, working six days of 24 hours each per week, was figured at a capital cost of £3,750.

A problem to which electro-metallurgical engineers have for a long time devoted themselves has been the direct smelting of iron ore by electrical means. Where cheap power is available, a great industry may be created; the iron ores of South Africa, India, Australia, Canada and Norway all await treatment by this means, and in New Zealand we have vast beds of magnetite or iron-sand yielding fully 50 per cent. of weight of pure metal, but hitherto so unamenable to ordinary smelting methods, that the New Zealand Government have in vain set aside a bounty of, we believe, £200,000, to be paid to the firm or firms who succeed in establishing a local iron industry based on the utilisation of these sands. The Anderson furnace, as adapted to reduction processes, demands that the material to be acted upon shall be first pulverised, so that in the case of iron-sands, these need not be briquetted. The ore is first mixed with the necessary flux and then supplied to the furnace by means of a hopper, the feeding being regulated by shutters in the connecting shutes. An adjustable electrode auxiliary to the two described in the refining furnace is situated immediately over the well of the furnace, and this serves to keep the metal in the receiver in a molten condition. This receiver may, with modifications, be used as a mixing vessel for the conversion of the iron into steel in one operation, or the pig-iron received from the electric reduction furnace may be carried in a molten state to a second or refining furnace. Both hematite and magnetite can be readily smelted, and an inferior charcoal is quite satisfactory as a reducing agent without briquetting. For the production of 60 tons of pig-iron per day of 24 hours, it may be taken that, assuming 5,000 H.P. to be available at a constructional cost for the power house of £10 per E.H.P., the total cost of plant would be about £55,100, excluding accessories such as crushers, elevators, storage, charcoal plant, &c., but including furnaces, regulators and their connections, instruments and cables, electrode plant and repair shop. Supposing that an ore containing 50 per cent. of pure iron is obtainable at 7s. per ton, and that electrical energy can be produced at 40s. per E.H.P.-year, the cost per ton of pig-iron produced, including charcoal, labour, limestone, electrodes and general expenses, interest and depreciation, repairs and renewals, and management expenses, should work out at about £2 15s. This figure for electricity is somewhat low, and hence it is essential for electric smelting that power can be obtained at a very cheap rate. The average energy consumption in this process is about 0·210 E.H.P.-year, or about 1,840 H.P.-hours, per ton of pig-iron produced.

It will, therefore, be seen that the electric furnace can compare very favourably with the blast furnace for the reduction of iron ore, where the above-mentioned condition of cheap power is obtainable, and there is the further point that a good ore runs no chance of becoming spoiled owing to the action of sulphurous gases, as sometimes occurs in the blast furnace, this leading to the fact that a far higher degree of purity can be obtained in the pig-iron. It will, therefore, be understood that the electrical production of iron and steel possesses points of interest to the manufacturer and engineer that are not merely academic, and it may not be very long before the work of such men as Mr. Scott Anderson, who is a gold medallist for metallurgical research, will be crowned with the success of a far-reaching industrial development.

It may fairly be said that the prejudice against electric furnaces, which was at one time very apparent in England, is very rapidly giving way to a realisation of their necessity, and an appreciation of the superiority of their product. To illustrate this it may be mentioned that Mr. Scott Anderson is now engaged on projects for electrical steel manufacture for several very important steel and engineering firms in Sheffield, Glasgow, and elsewhere. Furnaces are now being erected in Sheffield for the electric production of steel from ordinary scrap steel and iron, the product being in the form of high-grade castings, absolutely free from blow-holes, and tool steel. The steel in the billet costs a little under £6 per ton, and this is produced with scrap at £2 10s. per ton, and power generated from coal costing £1 5s. per ton, used in a gas producer plant. Following on this, it is expected that other furnaces on this system will be installed in Manchester, and at least one other centre, in the near future.

Another important project which is under consideration, is the production of high-grade steel billets direct from the ore, utilising extensive water rights for power purposes, and the fact that this question is now receiving almost universal consideration and approval is without doubt very strong evidence of the excellence of electric steel production. The electromagnets used with the Anderson furnace have proved the means of considerably reducing the current consumption, and thereby increasing the efficiency of the furnace, and this has contributed in no small degree to the satisfactory solution of this difficult problem.

German Enterprise in Austria.—The Bergmann Electricity Works Co., of Berlin, which is rapidly advancing to a position in the front rank of the principal manufacturing firms in Germany, has just established a subsidiary undertaking at Bodenbach, Bohemia, which has been registered as the Austrian Bergmann Electricity Works Co. The object of the new enterprise, which has an ordinary share capital of 500,000 crowns, is specially to erect and work an electricity works.

D.P. Batteries.—Amongst the orders which we are informed the D.P. Battery Co., Ltd., received last week, they have been commissioned by H.I.H. Empress Eugenie to install a storage battery of their LS 13 type at Farnborough Hill, and by the Crown agents for the Colonies to supply a battery of 118 L 15 type cells for the Bahamas. They have also received orders for 16 of their specially designed 25-volt batteries for private residences.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

GERMAN EAST AFRICA, CAMEROONS AND TOGOLAND.—The following articles are free of duty:—

All articles imported by the Government, the Imperial Admiralty and the Imperial Postal Service; machines and instruments, materials and working plant, directly intended for building, repairing and operating railways and other means of conveyance; machinery for industrial and mining operations; means of transport of every description; physical, astronomical, chemical, mathematical, optical and like scientific instruments.

Electrical and similar materials not capable of being classed amongst the above-named goods would be dutiable at the rate of 10 per cent. *ad valorem*.

GERMAN NEW GUINEA.—The following are free of duty:—

All goods imported by the Government; physical, astronomical, chemical, mathematical, optical and similar instruments to be used for scientific purposes; transport materials of all kinds; machines for the immediate purpose of carrying on construction for communication, waterworks, &c.; railway lines and sleepers, telegraph wires, &c.; articles imported by the Postal and Naval authorities.

Other electrical and similar goods not capable of being included under any of the above headings would be dutiable at the rate of 10 per cent. *ad valorem*.

GERMANY—SAMOA.—A duty of 10 per cent. *ad valorem* is levied on electrical and similar goods.

GERMAN SOUTH-WEST AFRICA.—Electrical and similar goods are duty free.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,400. "Device for testing the pull or strength of magnets." E. C. F. Otto. September 20th.

21,416. "Improvements in ignition apparatus for internal-combustion engines." W. Mills. September 20th.

21,424. "Improvements in ejectors electrically operated." E. M. T. Boddam. September 20th.

21,434. "Improvements in magneto-electric ignition apparatus for internal-combustion engines." F. H. Hall. September 20th.

21,441. "Improved method of controlling electrical quantities by means of sound waves and apparatus therefor." F. J. Chambers. September 20th.

21,480. "Improvements in or relating to electrolytic condensers." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 20th.

21,481. "Improvements in and relating to electric energy meters." British Thomson-Houston Co., Ltd., and C. R. d'Arcy. September 20th.

21,517. "Improvements in and relating to electric batteries or accumulators." A. W. Somers and R. J. Crowley. (Application for Patent of Addition to No. 5,064, 1909.) September 1st.

21,526. "Improved insulator for supporting the current rails of electric railways and tramways." A. Watkins. September 21st.

21,529. "Improvements in static induction generators or influence machines." C. Harrison. (B. E. Baker, United States.) September 21st. (Complete.)

21,540. "Improvements in polyphase commutator dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., United States.) September 21st. (Complete.)

21,541. "Improvements in apparatus for regulating the transfer of electrical energy between two electrical systems having different electric frequencies." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) September 21st. (Complete.)

21,542. "Improvements in and relating to polyphase commutator dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) September 21st. (Complete.)

21,564. "Improvements in electric heaters." J. C. Royce. September 21st. (Complete.)

21,577. "Improvements in and relating to machines for use in the manufacture of incandescent electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 21st.

21,595. "Improvements in liquid controllers and starters for electric motors." J. A. Liddle. September 22nd.

21,596. "Improved inspection and extension fitting for electric wiring." A. J. Burfitt. September 22nd.

21,603. "Improvements in dynamos and motors." J. A. Liddle. September 22nd.

21,622. "Improvements in motor-generators, boosters, balancers, auto-transformers, and generators for direct and alternating-current circuits." A. M. Taylor. September 22nd.

21,637. "Improvements in electric telegraphs particularly applicable to transmitting signals on board ship." W. F. Grafton. September 22nd.

21,659. "Impedance switches and regulators." H. J. Herberts. September 22nd.

21,669. "Improvements in installations of electrically-propelled vehicles for the purpose of obtaining current for braking." G. Rizzo. (Date applied for under Rule 18, March 22nd, 1909. An invention comprised in application No. 6,849, dated March 22nd, 1909.) September 22nd.

21,682. "Improvements in voltage-regulators for dynamo-electric machines." T. Ferguson. September 23rd.

21,701. "Improvement in the ignition of combustion engines." H. Portway. September 23rd.

21,732. "Improvements relating to the senders of tele-selectors." E. Blos. September 23rd. (Complete.)

21,803. "Improved means for automatically controlling the reversal of electrically-driven machine tools." W. Beardmore & Co., Ltd., and J. A. Sykes. September 24th.

21,807. "Improvements in electric lifts." E. M. T. Boddam. September 24th.

21,845. "Improved method of obtaining constant potential in an electric circuit supplied from a generator running at variable speed particularly applicable to the electric lighting of railway trains and the like." W. F. Grafton. September 24th.

21,854. "Improvements in and relating to electric lamp fittings." J. Gray. (F. J. Seabolt, United States.) September 24th. (Complete.)

21,858. "Improvements in and connected with the ignition contrivances of internal-combustion engines." A. Gray. September 24th. (Complete.)

21,904. "Improvements in or connected with microphones, receivers of telephones and the like." T. W. Newman. September 25th.

21,940. "Improvements in electric clock winding mechanism." J. Gray F. J. Seabolt, United States.) September 25th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Method of and Apparatus for Electrical Separat on. W. Fairweather. (Huff Electrostatic Separator Co.) 16,583. August 6th.

Electric Signalling on Railways. G. H. Brown. 18,996. September 10th.

Electric Light and Similar Electrical Fittings. A. T. Woodhall and A. Emery. 19,150. September 11th.

Method and Means of Transforming Electrical Energy into Heat Energy. C. O. Bastian. 19,333. September 15th.

Overhead Conductors for Electric Railways and Tramways. J. Ormston and W. E. Charlton. 20,647. October 1st. (Cognate application 6,584/09.)

Clamping Devices for Electrical Fittings. Siemens Bros. & Co. and J. Huddleston. 21,912. October 16th.

Magneto-Ignition Apparatus. Firm Robert Bosch. 25,547. November 26th. (Date applied for under International Convention, November 6th, 1908.)

Magnetic Blow-Outs for Electric Switches. T. von Zweigbergk. 26,954. December 1st.

Electric Furnaces. C. Bingham. 26,956. December 5th.

Automatic Electric Timing Switch. F. W. W. Baker and G. Pearce. 27,328. December 16th.

Contact Device on a Travelling Bridge-Crane to Convey Current from an Electric Overhead Conductor to an Electric Locomotive passing under the same without Interfering with the Working of the Crane. C. K. Mills. (Maschinen und Dampfkesselfabrik "Guilleaume Werke" Ges., Germany.) 28,076. December 24th.

Holders or Sockets for Incandescent Electric Lamps. H. W. Marsh. 28,177. December 24th.

1909.

Service Registers in Telephone Installations. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 10,203. April 29th.

Electric Safety Lamps. G. O. Wolters. 10,312. April 30th. (Date applied for under International Convention, May 2nd, 1908.)

Telephone Transmitters. C. E. Egner and J. G. Holmstrom. 12,918. June 1st.

Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges., Germany.) 17,104. July 24th.

Electric Smelting Process.—A new electro-thermic smelting process has been introduced at the works of the Canadian Zinc Co., at Nelson, British Columbia. The electric furnace, which was devised by Mr. F. T. Snyder, technical adviser to the company, is, in its general construction, very like an ordinary, rectangular, water-jacketed, lead blast furnace, with inside dimensions of 34 × 54 in. At either end a carbon electrode is conducted through the end jackets, while a third electrode is connected and built into the furnace bottom. From a framework above, three cylindrical carbon electrodes, 9 in. in diameter, are lowered into the furnace, their height above the bottom being regulated by suitable gearing hung from the roof. In operation, the electric current, entering by these three suspended electrodes, passes to either the end or bottom electrodes, the electric arc so formed generating the requisite heat for smelting the ore, which is fed into the furnace from the charging floor level, around the electrodes. The products of the fusion are: Slag and matte run off through a suitable iron spout; lead, collected in the bottom of the furnace, and ladled out of a lead well; and metallic zinc, which is condensed on the cool sides of the jackets and, running down, flows out of openings in the side of the furnace, through carbon blocks, perforated by small holes. The capacity of the furnace is as yet a matter of expectation only, but it is anticipated that it will be capable of treating about 15 tons of ore per day, the consumption of power being estimated at 50 E.H.P. per ton of ore (? per day). The necessary current is obtained from the Bonnington Falls plant, and is delivered by that concern at the south-east side of Nelson, across which town the Canadian Zinc Co. has had to carry it; for this purpose, a pole line, about 3 miles in length, has had to be erected, a high standard of construction having been demanded by the town authorities as a condition to its permission to pass through the public streets. The high-voltage current enters the works directly to a transformer house, which is equipped with transformers capable of dealing with about 750 E.H.P. The experiment is being watched with interest in ore-smelting circles in Canada.